Mode	Data rate (Mbps)	Target application	Receiver sensitivity	Power consumption ('2001)	
				Rx. average	Tx. average
Mode 1.0 (Bluetooth)	1 Mbps		-84 dBm	25 mW	15mW
Mode 2.0	2.6-3.9 Mbps	Audio	-78 dBm	30 mW	20 mW
Mode 3.0	22-44 Mbps	Video, computer graphics	-69 dBm	95 mW	60 mW

TDS020-802.x.60

Figure 1

P05020-030224360

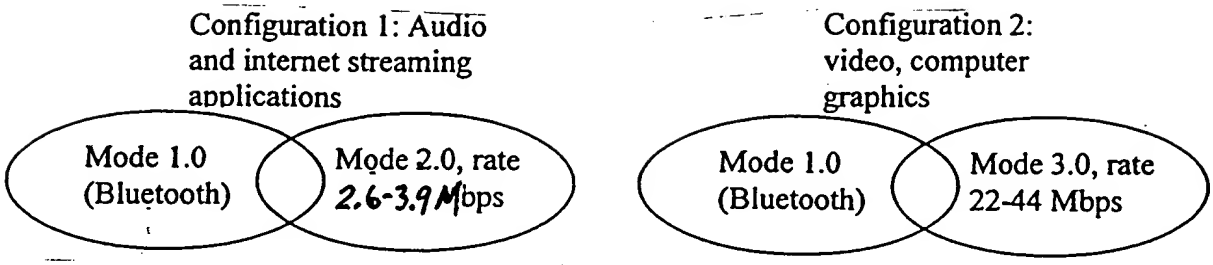

Figure 2

Parameters	Mode 1 (Bluetooth)	Mode 2
Frequency hopping	1600 Hz	Same as Bluetooth
Filter spectrum		Same as Bluetooth [redacted]
Modulation	GFSK	16, 64 QAM
Maximum data rate	1 Mbps	2.6, 3.9 Mbps
Acquisition		Using mode 1 then switch to mode 2
Transmit power	0 dBm	0 dBm, 6 dBm
Distance	10 m.	10 m.
Nominal packet error rate	10 %	10 %
Margin + Noise figure	37 dB	37 dB
Receiver sensitivity	-84 dBm	-84, -78 dBm
Coding	ARQ	ARQ + convolutional code across packets

TI0520-E02227.60

Figure 3

Frequency offset	Transmit power
+/- 550 kHz	-20 dBc
|M-N| = 2	-20 dBm
|M-N| >= 3	-40 dBm

Figure 4

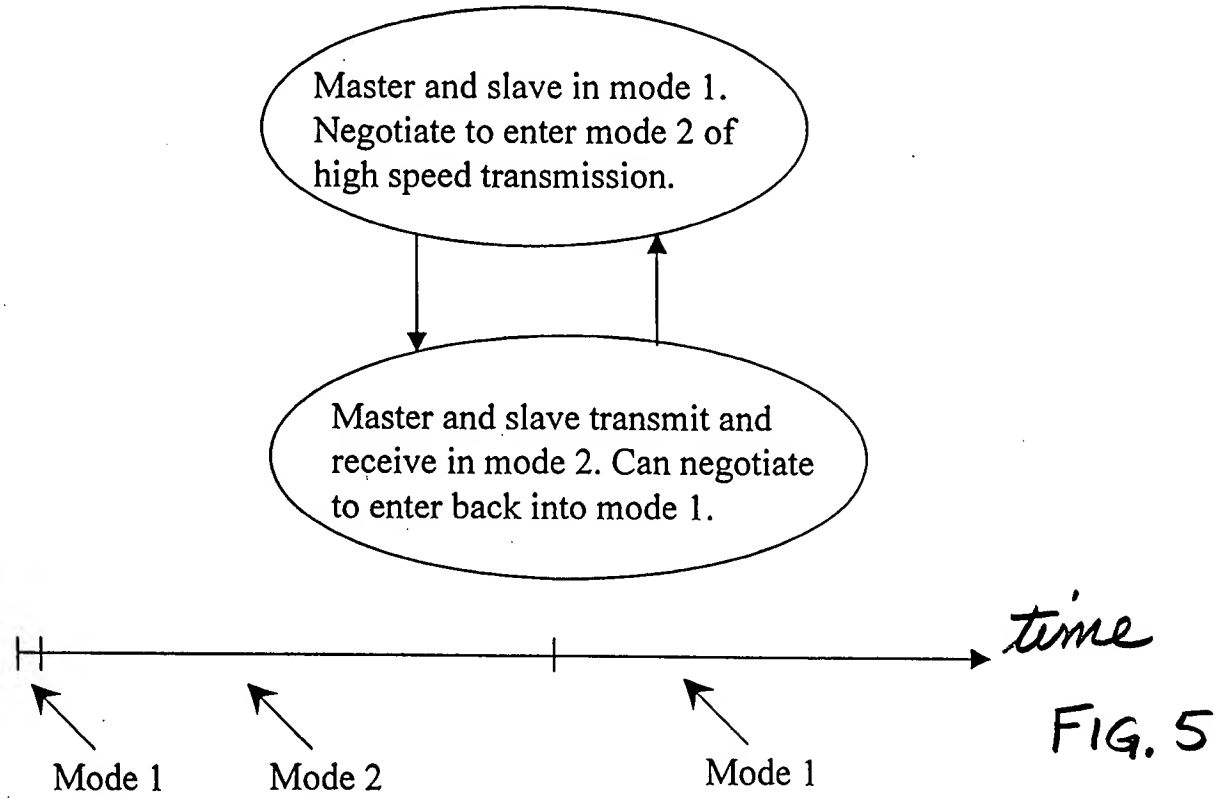
Master and slave in mode 1. Negotiate to enter mode 2 of high speed transmission.
Master and slave transmit and receive in mode 2. Can negotiate to enter back into mode 1.
time
Mode 1
Mode 2
Mode 1

FIG. 5

T0502620-020202-P50

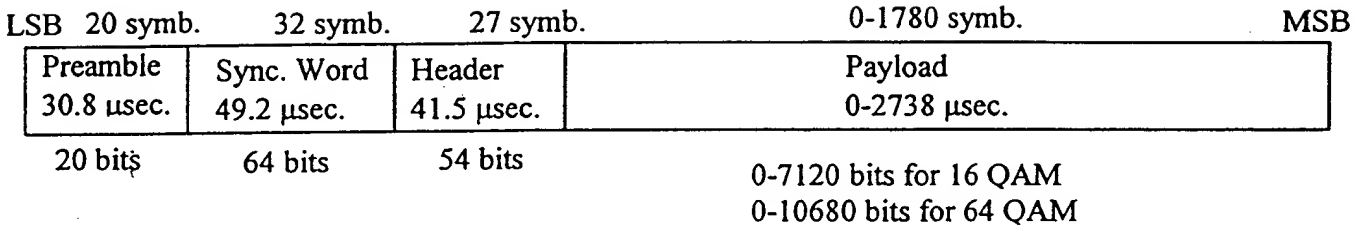

Figure 6

EP 0 950 310 B1

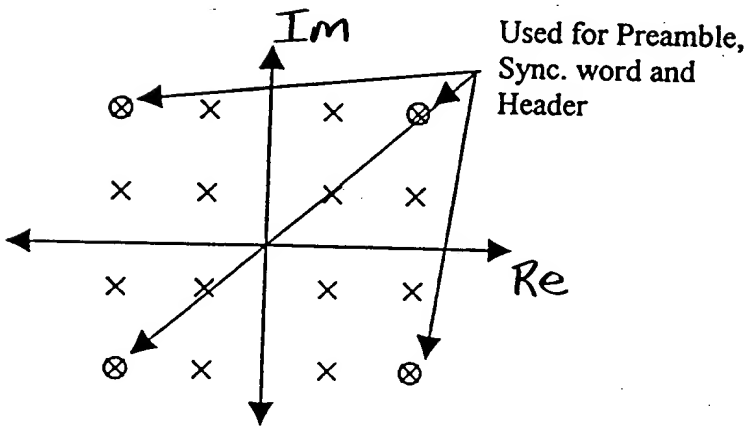

Figure 6A

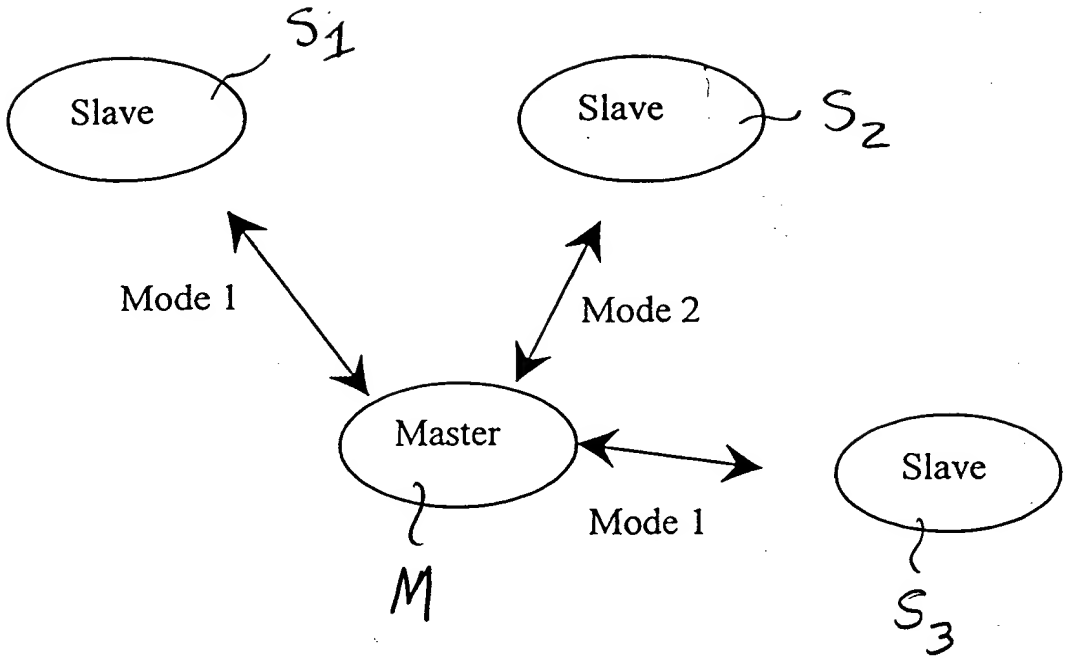

Figure 7

EP 0 530 760 A2

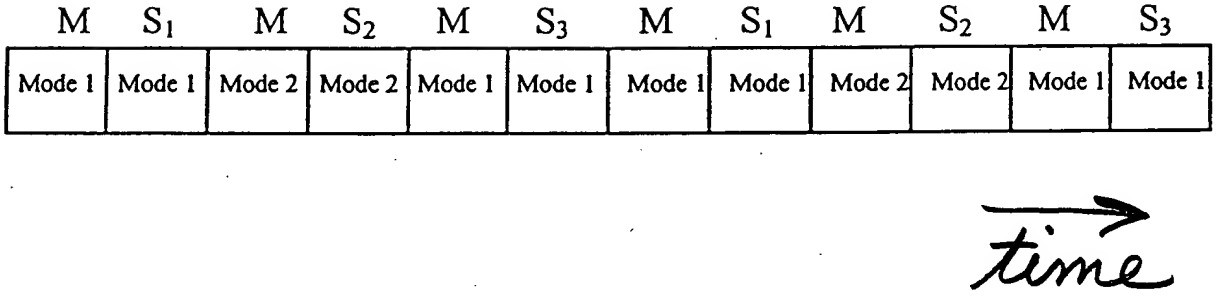

Figure 8

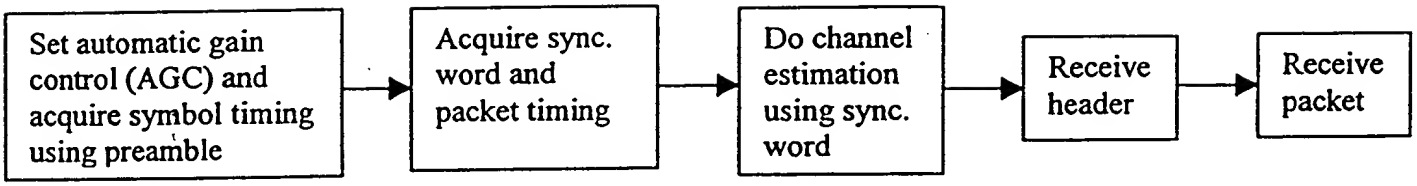
Set automatic gain control (AGC) and acquire symbol timing using preamble
Acquire sync. word and packet timing
Do channel estimation using sync. word
Receive header
Receive packet

Figure 9

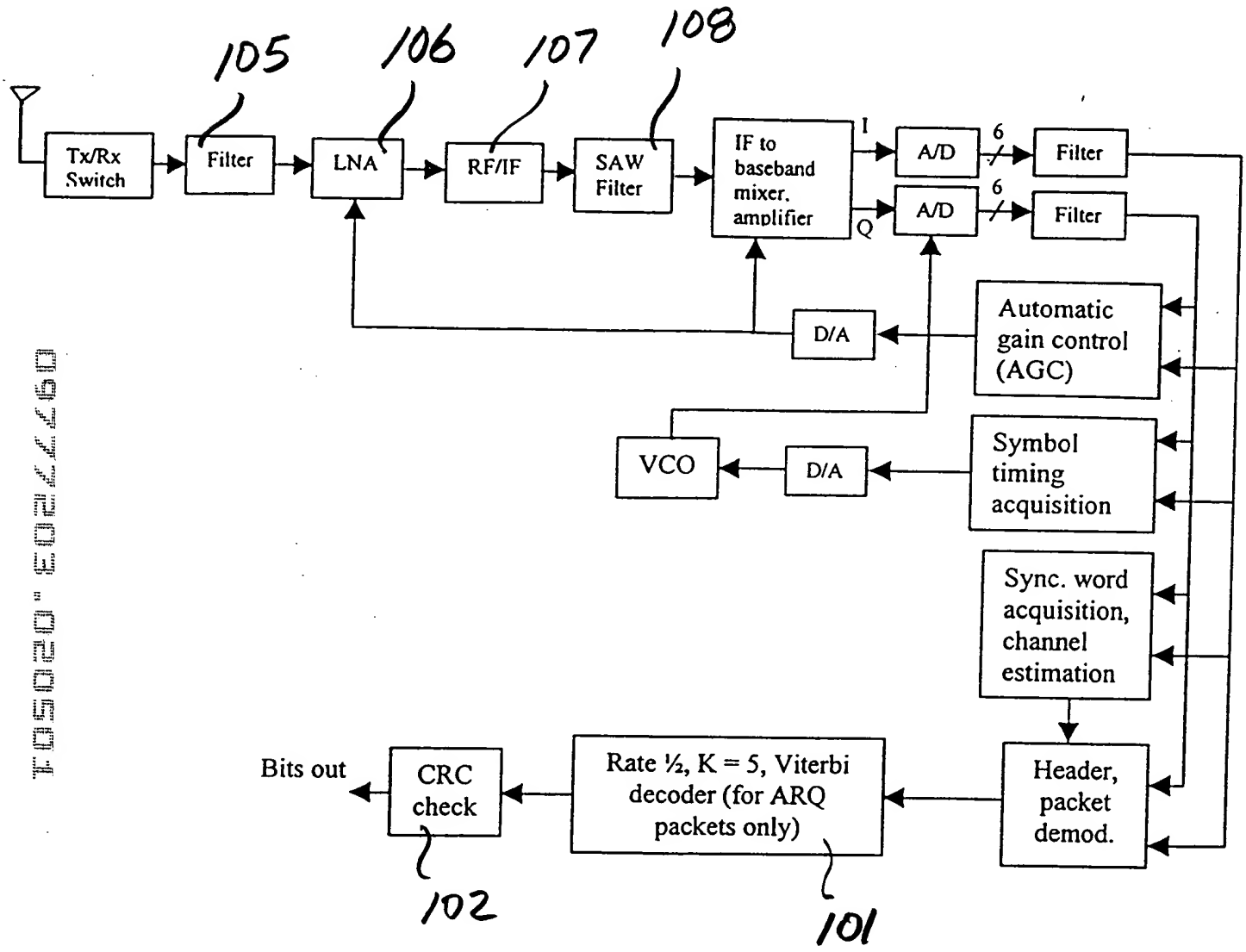
105
106
107
108
Tx/Rx Switch
Filter
LNA
RF/IF
SAW Filter
IF to baseband mixer, amplifier
I
Q
A/D
A/D
6
6
Filter
Filter
D/A
Automatic gain control (AGC)
VCO
D/A
Symbol timing acquisition
Sync. word acquisition, channel estimation
Header, packet demod.
Rate ½, K = 5, Viterbi decoder (for ARQ packets only)
CRC check
Bits out
102
101

Figure 10

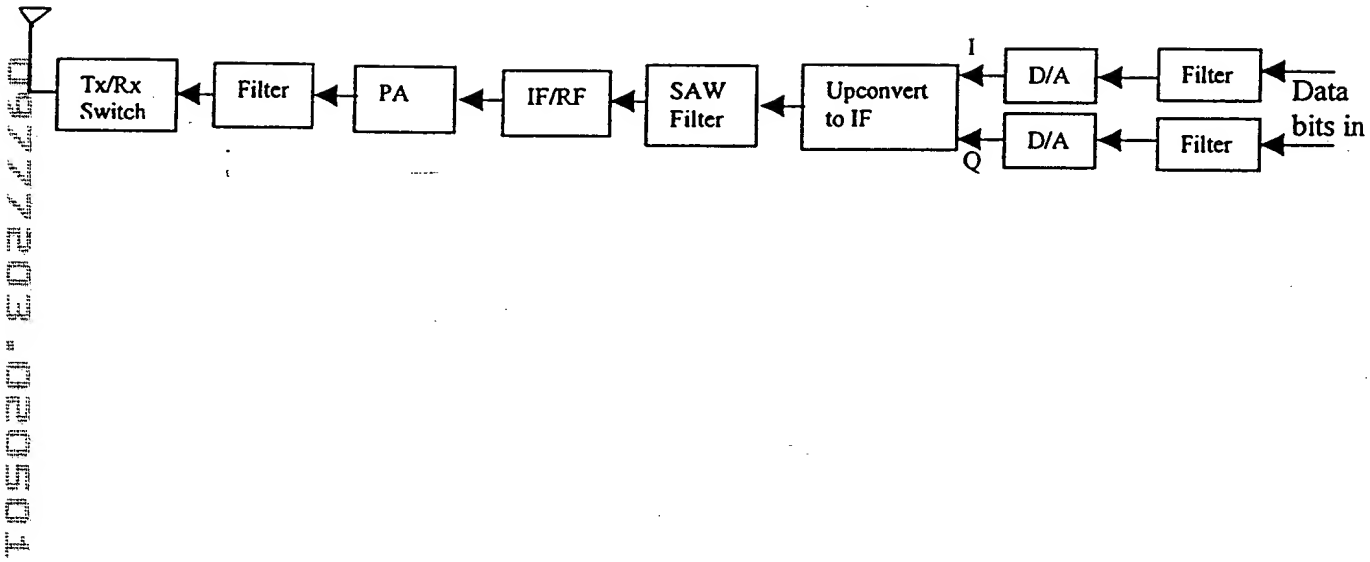
Tx/Rx Switch
Filter
PA
IF/RF
SAW Filter
Upconvert to IF
I
Q
D/A
D/A
Filter
Filter
Data bits in

Figure 11

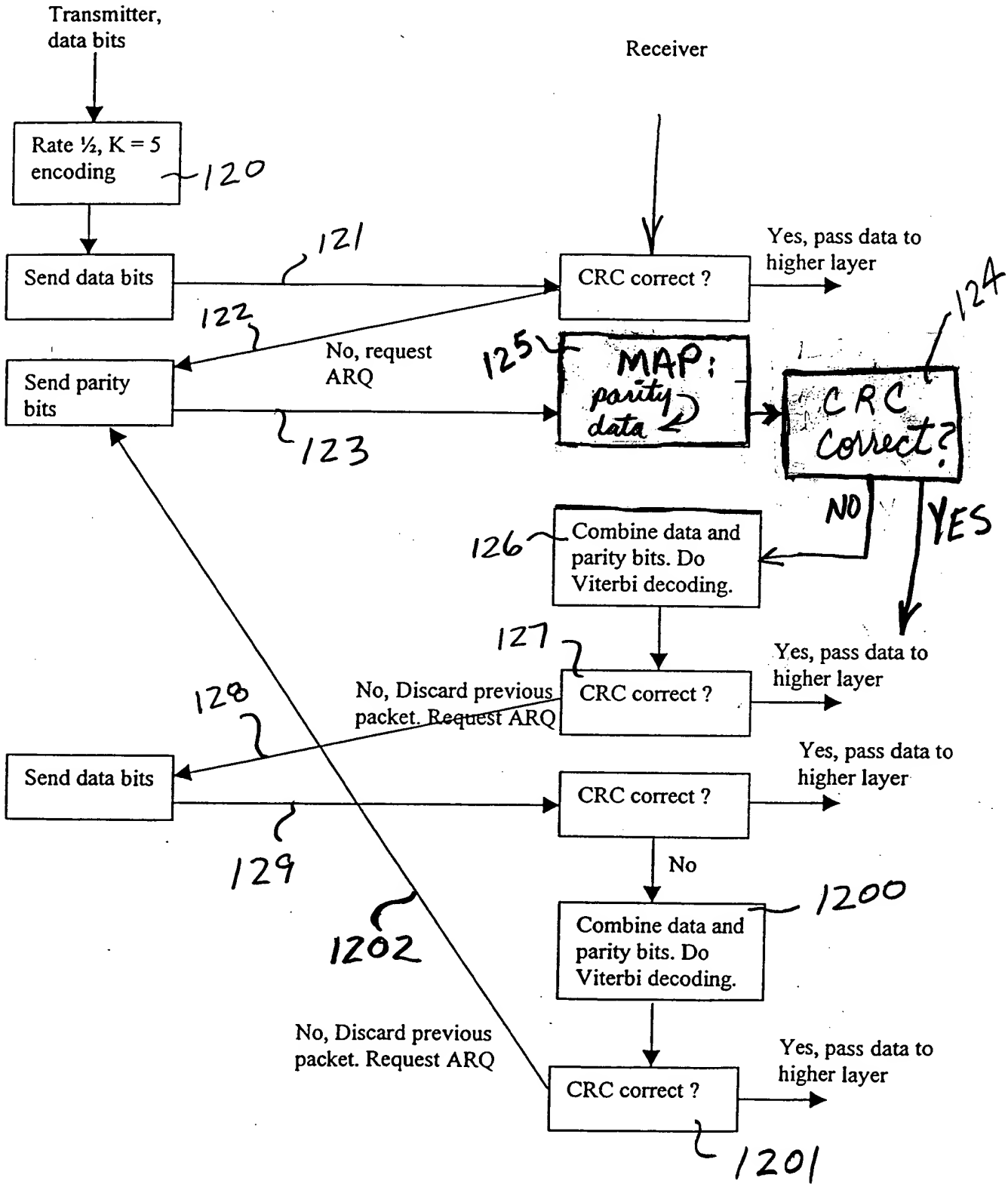
Transmitter, data bits
Receiver
Rate ½, K = 5 encoding
120
Send data bits
121
CRC correct ?
Yes, pass data to higher layer
122
No, request ARQ
Send parity bits
123
125
MAP: parity data
CRC correct?
124
NO
YES
126
Combine data and parity bits. Do Viterbi decoding.
127
CRC correct ?
Yes, pass data to higher layer
No, Discard previous packet. Request ARQ
128
Send data bits
129
CRC correct ?
Yes, pass data to higher layer
No
1200
Combine data and parity bits. Do Viterbi decoding.
1202
No, Discard previous packet. Request ARQ
CRC correct ?
Yes, pass data to higher layer
1201

Figure 12

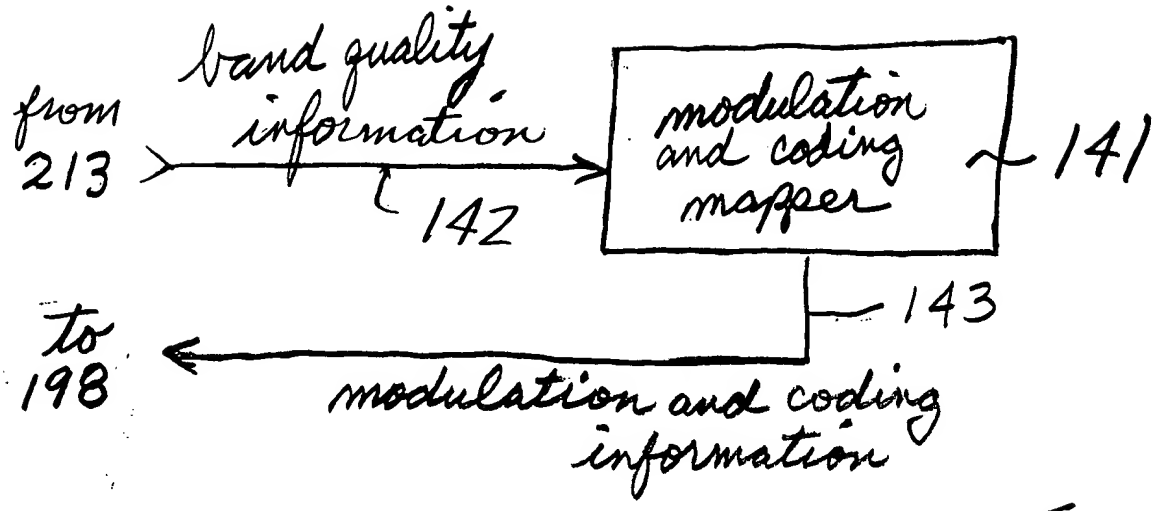

FIG. 14B

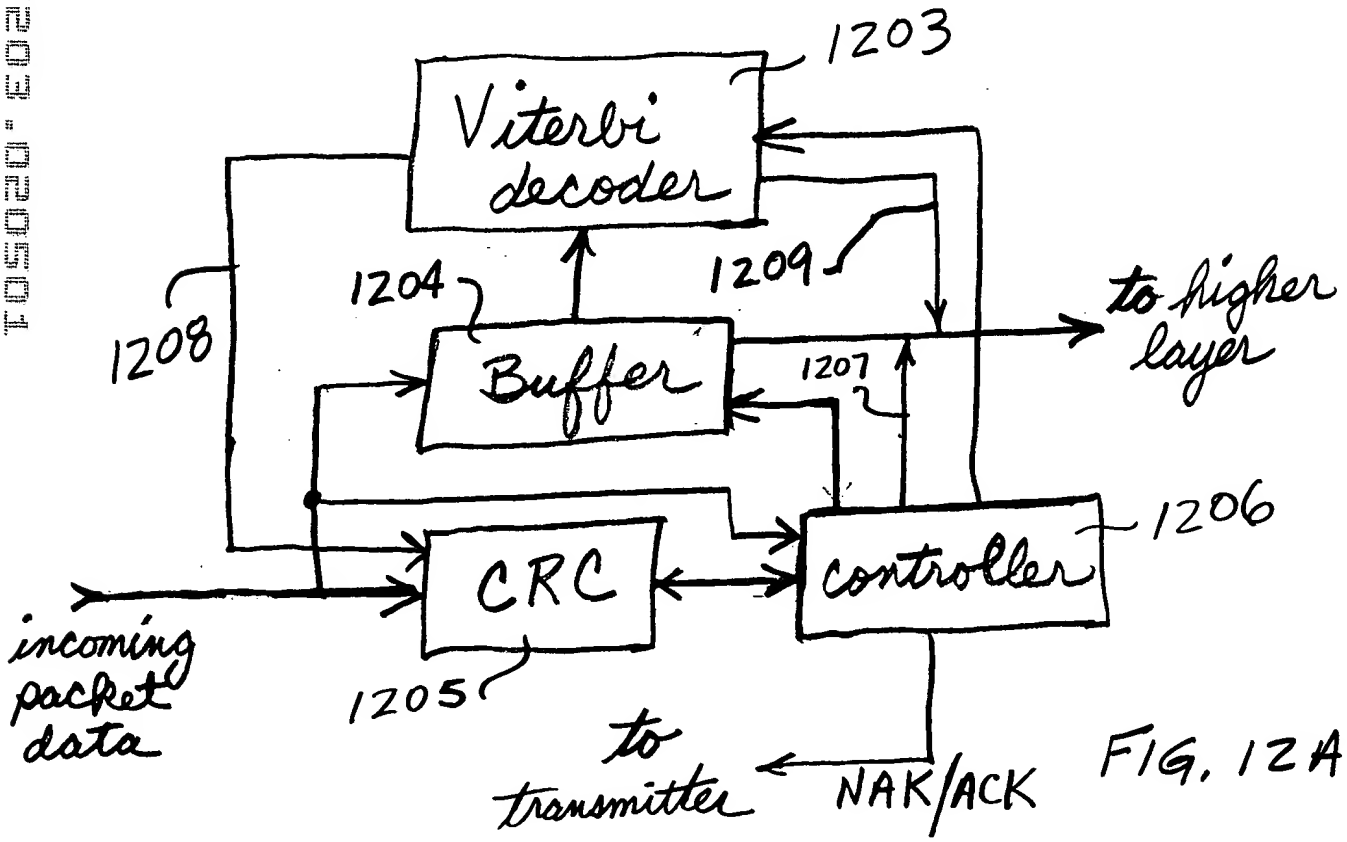

FIG. 12A

EOS020 · E02/2/260

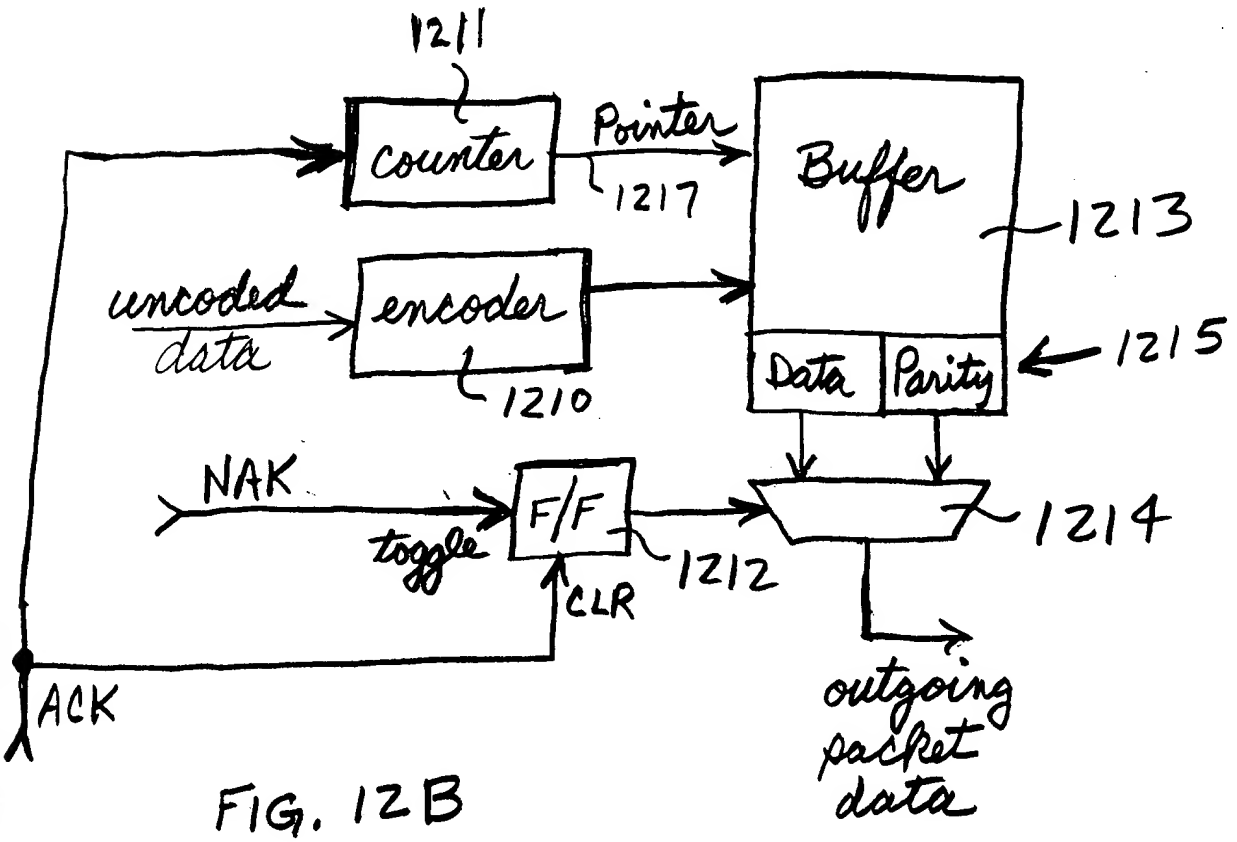

FIG. 12B

EXHIBIT 1050 - 60/276,650

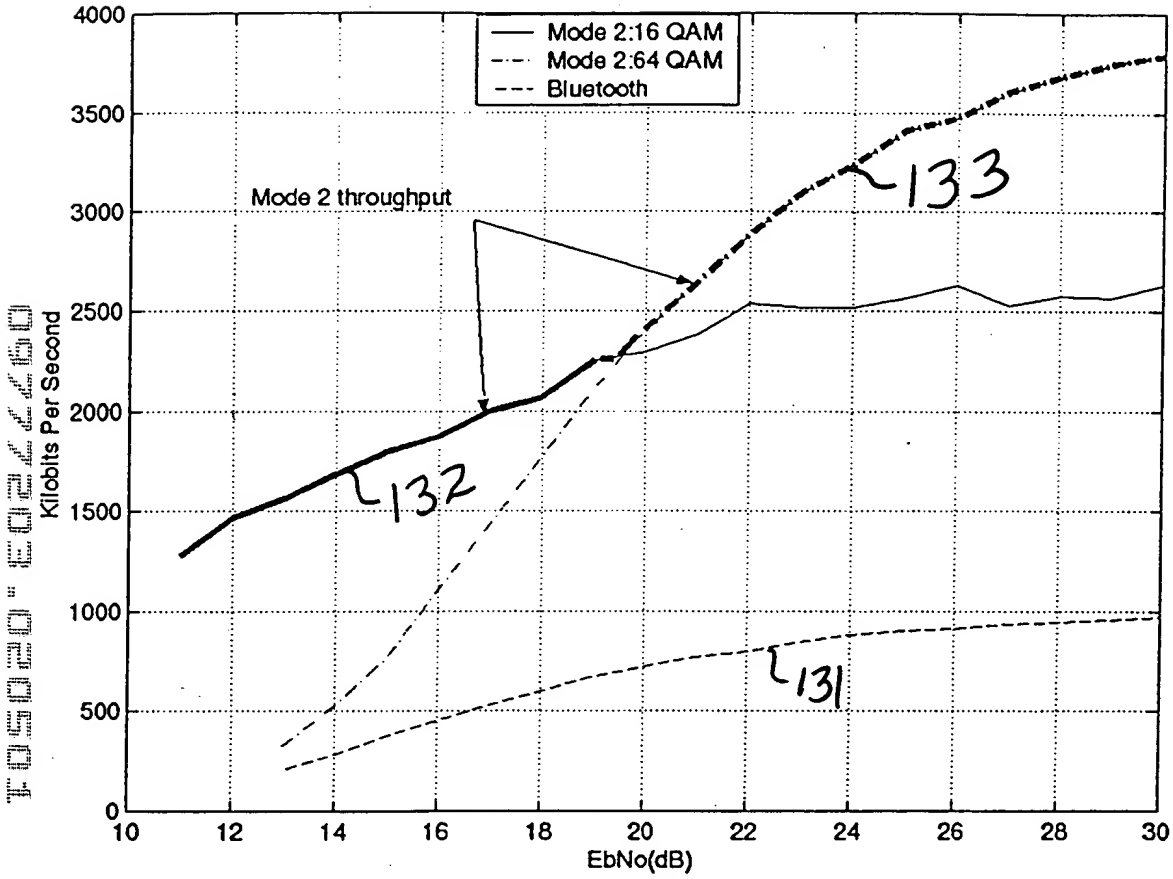
Mode 2:16 QAM
Mode 2:64 QAM
Bluetooth
Mode 2 throughput
132
133
131
Kilobits Per Second
EbNo(dB)
0
500
1000
1500
2000
2500
3000
3500
4000
10
12
14
16
18
20
22
24
26
28
30

Figure 13

Parameters	1	2	3	4	5
Filter spectrum	802.11b	802.11b	802.11b	802.11b	802.11b
Modulation	QPSK	QPSK	16 QAM	16 QAM	16 QAM
Scrambling code length	256	256	256	256	256
Physical data rate	22 Mbps	22 Mbps	44 Mbps	44 Mbps	44 Mbps
Coding	Rate ½, Turbo (SCCC)	None	Rate ½, Turbo (SCCC)	Rate ¼, Turbo (SCCC)	None
ARQ	Optional	Optional	Optional	Optional	Optional
Maximum data rate	**11 Mbps**	**22 Mbps**	**22 Mbps**	**33 Mbps**	**44 Mbps**
Transmit power	-1 dBm	8 dBm	4 dBm	8 dBm	15 dBm
Distance	10 m.	10 m.	10 m.	10 m.	10 m.
Bit error rate	1e-8	1e-8	1e-8	1e-8	1e-8
Packet error rate	1e-4	1e-4	1e-4	1e-4	1e-4
Margin+Noise figure	37 dB	37 dB	37 dB	37 dB	37 dB
Receiver sensitivity	-85 dBm	-76 dBm	-80 dBm	-76 dBm	-69 dBm
Frequency diversity	Band selection	Band selection	Band selection	Band selection	Band selection
SYMBOL RATE	11 Msps	11 Msps	11 Msps	11 Msps	11 Msps
SPREADING	11 Mcps	11 Mcps	11 Mcps	11 Mcps	11 Mcps

Figure 14

	Max. data rate	Modulation	Symbol rate	Coding	Spreading
18	18 Mbps	QPSK	18 Msps	rate 1/2	18 Mchips/sec
19	36 Mbps	QPSK	18 Msps	rate 1	18 Mchips/sec
20	36 Mbps	16 QAM	18 Msps	rate 1/2	18 Mchips/sec
21	54 Mbps	16 QAM	18 Msps	rate 3/4	18 Mchips/sec
22	72 Mbps	16 QAM	18Msps	rate 1	18 Mchips/sec

FIG. 14A

T-SQ20-E02/2760

Parameters	6	7	8	9	10
Filter spectrum	802.11b	802.11b	802.11b	802.11b	802.11b
Modulation	QPSK	QPSK	QPSK	QPSK	QPSK
Scrambling code length	256	256	256	256	256
Physical data rate	22 Mbps	22 Mbps	22 Mbps	22 Mbps	22 Mbps
Coding	Rate ½, Turbo	Rate 2/3, Turbo	Rate ¾, Turbo	Rate 4/5, Turbo	Rate 5/6, Turbo
ARQ	Optional	Optional	Optional	Optional	Optional
Maximum data rate	11 Mbps	14.67 Mbps	16.5 Mbps	17.6 Mbps	18.33 Mbps

FIG. 14C

EL550220502US

Parameters	11	12	13	14	15	16	17
Filter spectrum	802.11b	802.11b	802.11b	802.11b	802.11b	802.11b	802.11b
Modulation	8-PSK	8-PSK	8-PSK	8-PSK	8-PSK	8-PSK	8-PSK
Scrambling code length	256	256	256	256	256	256	256
Physical data rate	33 Mbps	33 Mbps	33 Mbps	33 Mbps	33 Mbps	33 Mbps	33 Mbps
Coding	None	Rate1/3, Turbo	Rate ½, Turbo	Rate 2/3, Turbo	Rate ¾, Turbo	Rate 4/5, Turbo	Rate 5/6, Turbo
ARQ	Optional	Optional	Optional	Optional	Optional	Optional	Optional
Maximum data rate	33 Mbps	11 Mbps	16.5 Mbps	22 Mbps	24.75 Mbps	26.4 Mbps	27.5 Mbps

FIG. 14D

T-5520-E0624760

Frequency offset	Transmit power
fc	0 dBc
+/- 11MHz	-30 dBc
+/- 22 MHz	-50 dBm

Figure 15

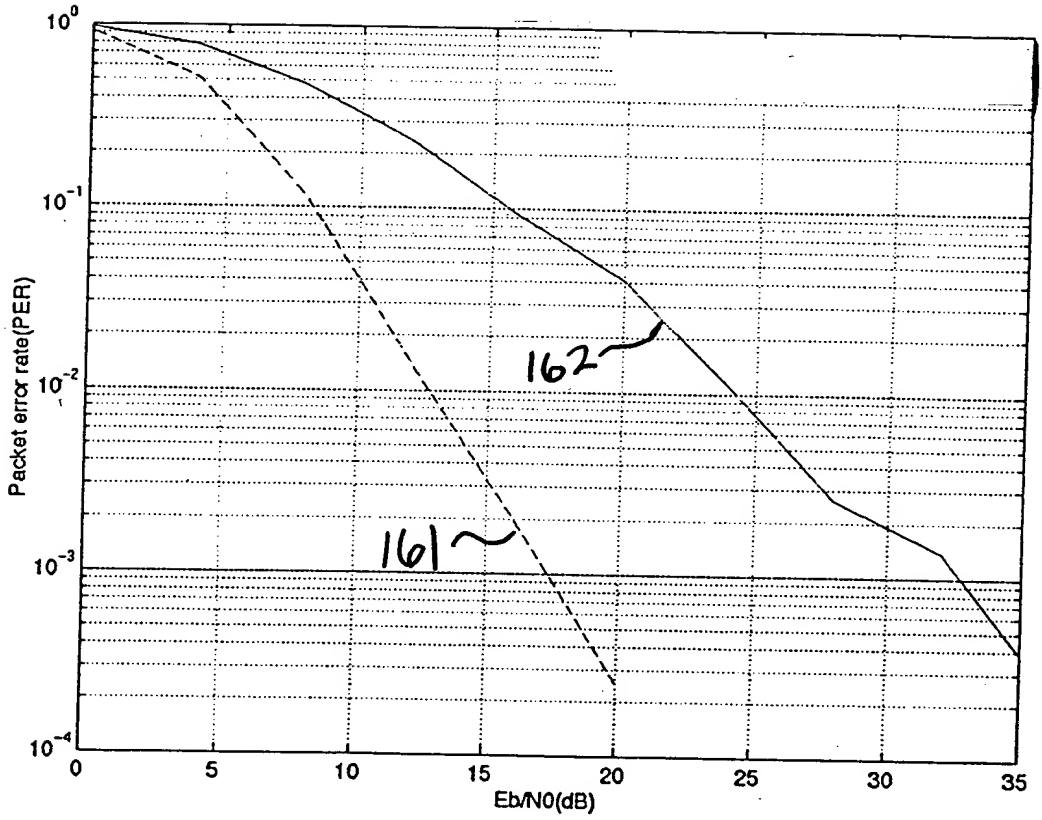

Figure 16

EASON: EO2424.60

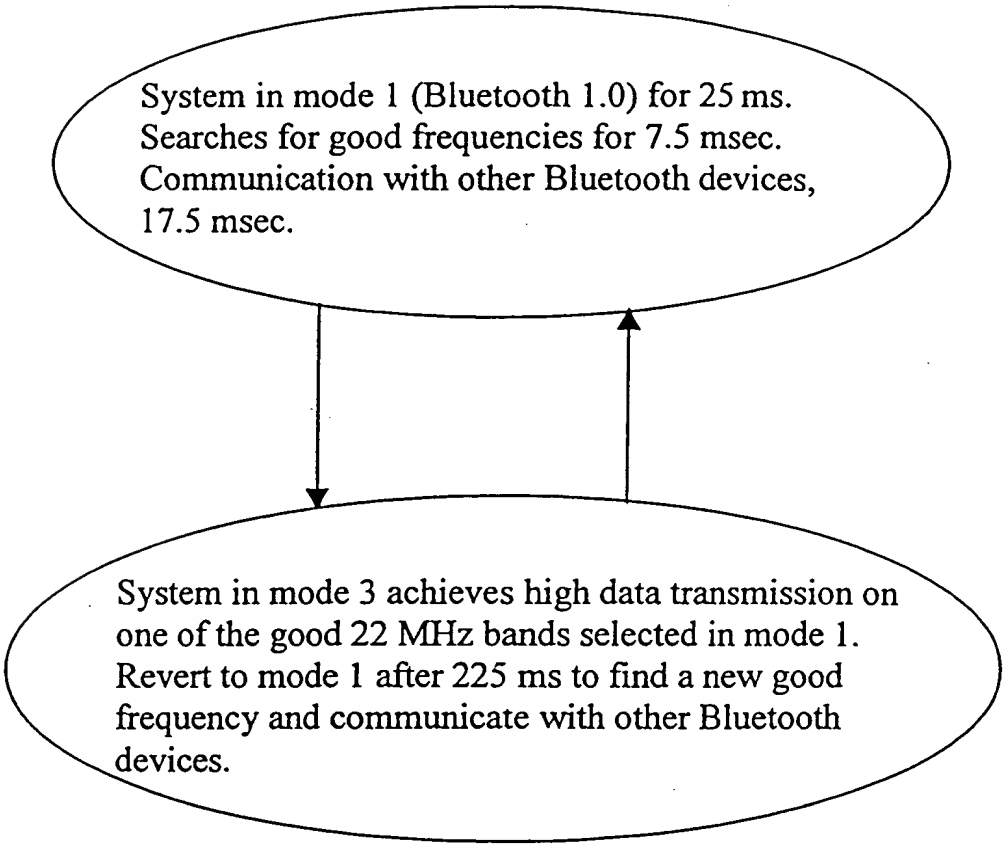

Figure 17

FOSDAGO: 20220250

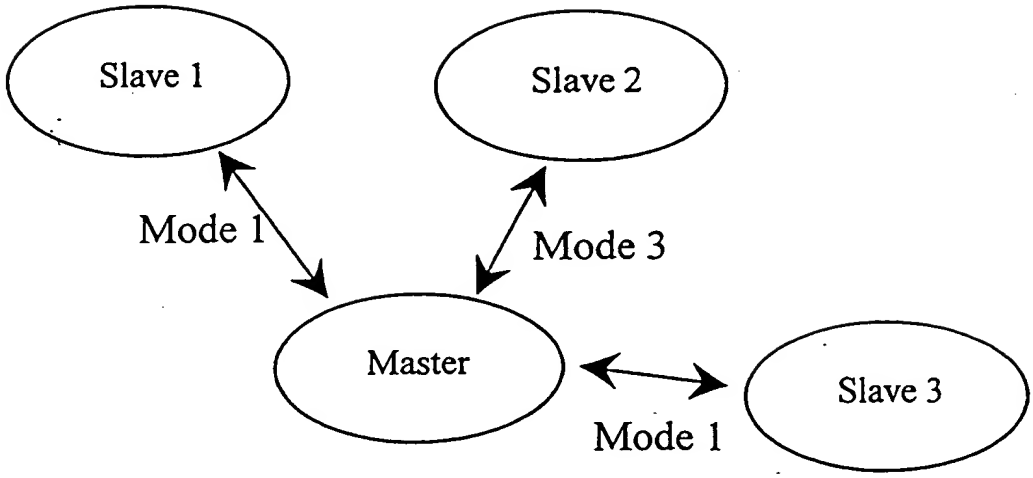

Figure 18

EC5020 "EQ24250

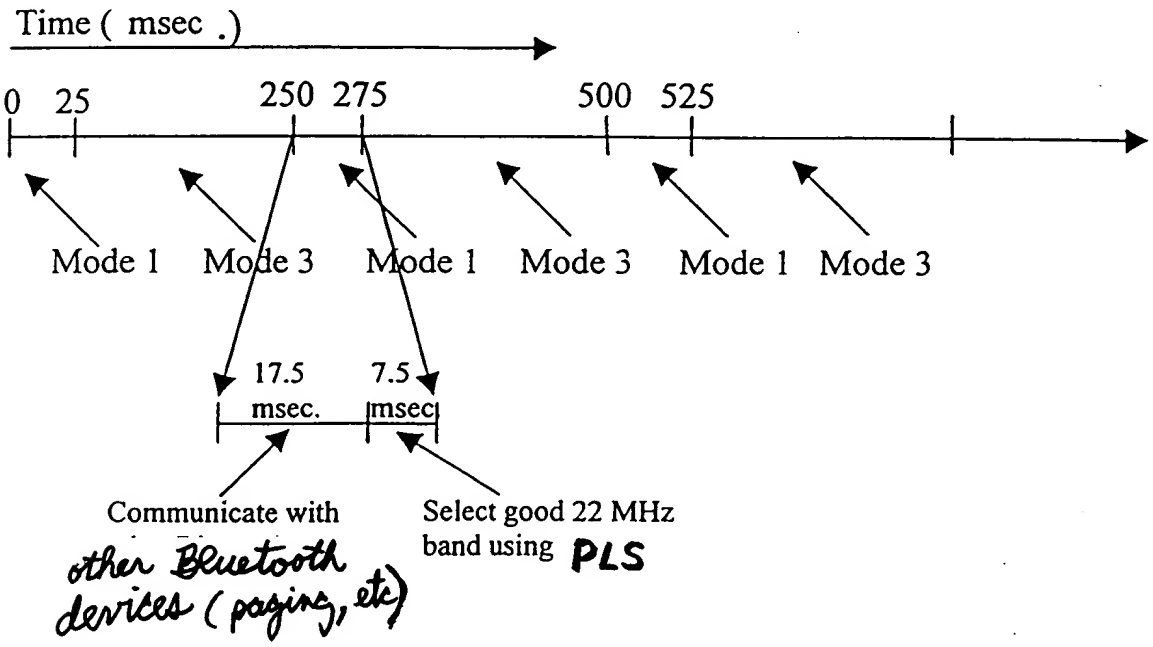

Figure 19

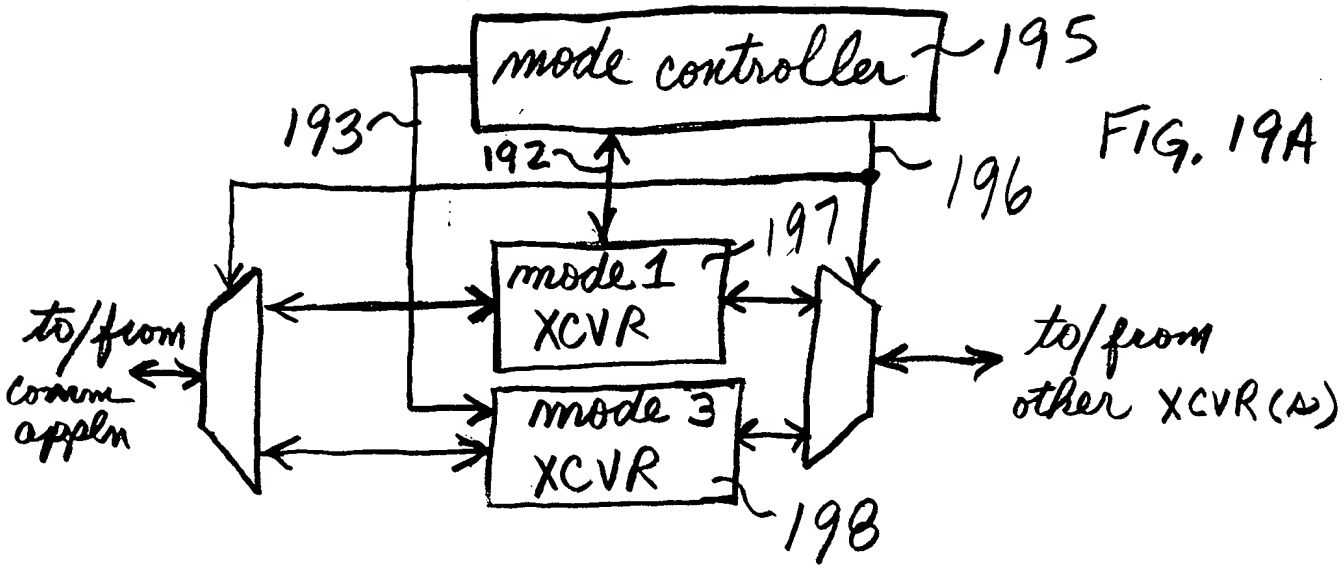

FIG. 19A

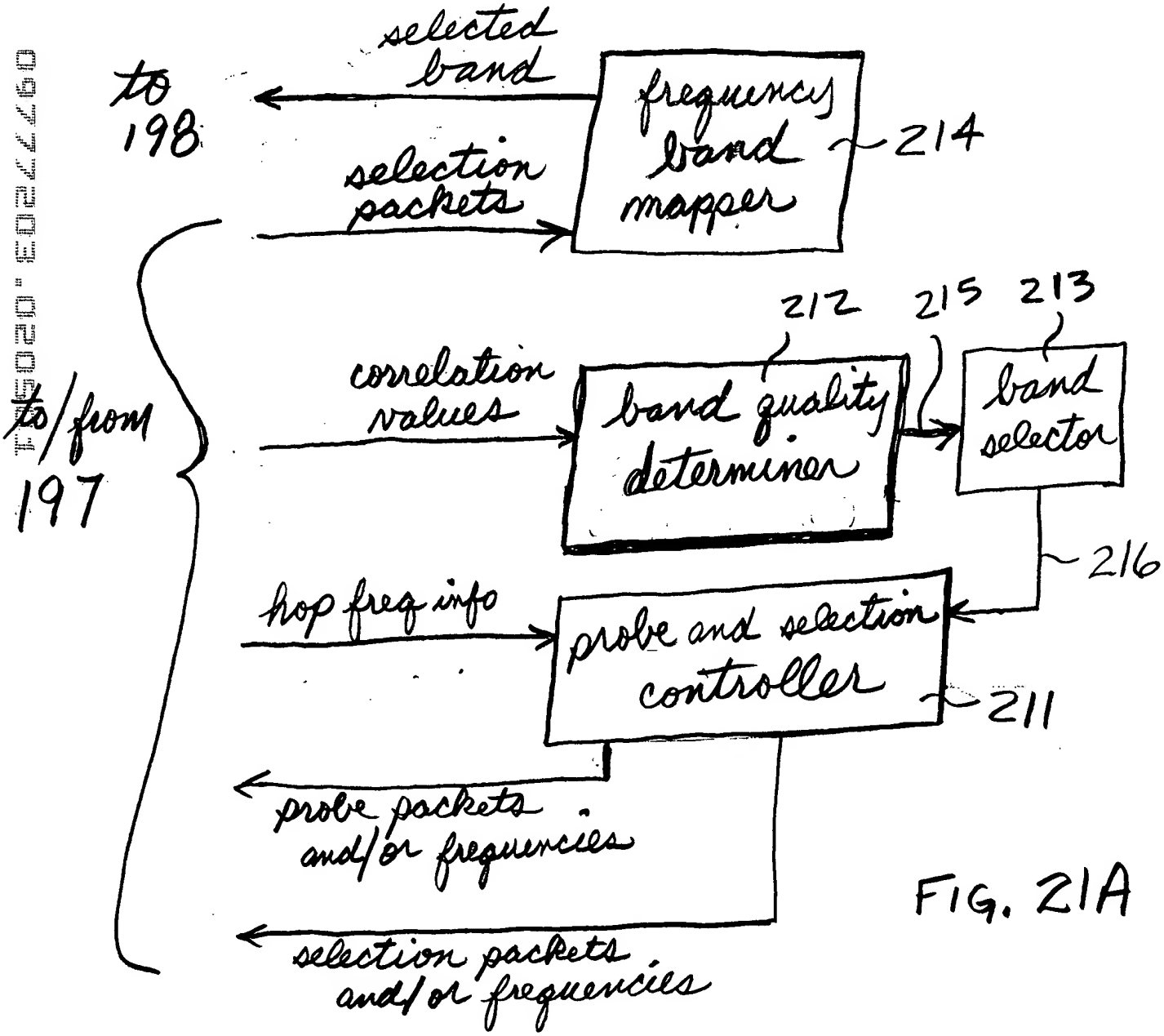

FIG. 21A

T0530 "E0224450

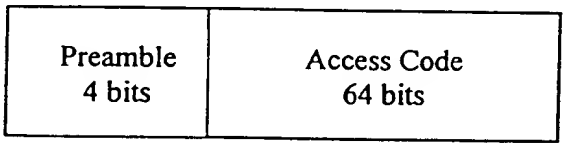

Figure 20

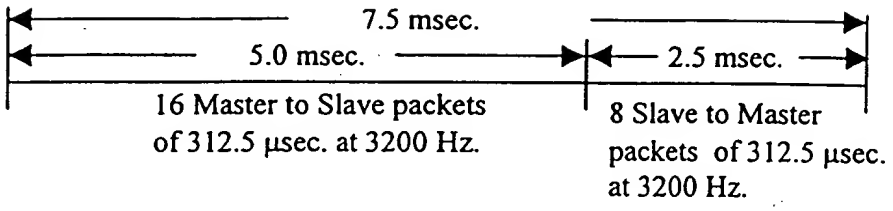
7.5 msec.
5.0 msec.
2.5 msec.
16 Master to Slave packets of 312.5 µsec. at 3200 Hz.
8 Slave to Master packets of 312.5 µsec. at 3200 Hz.

Figure 21

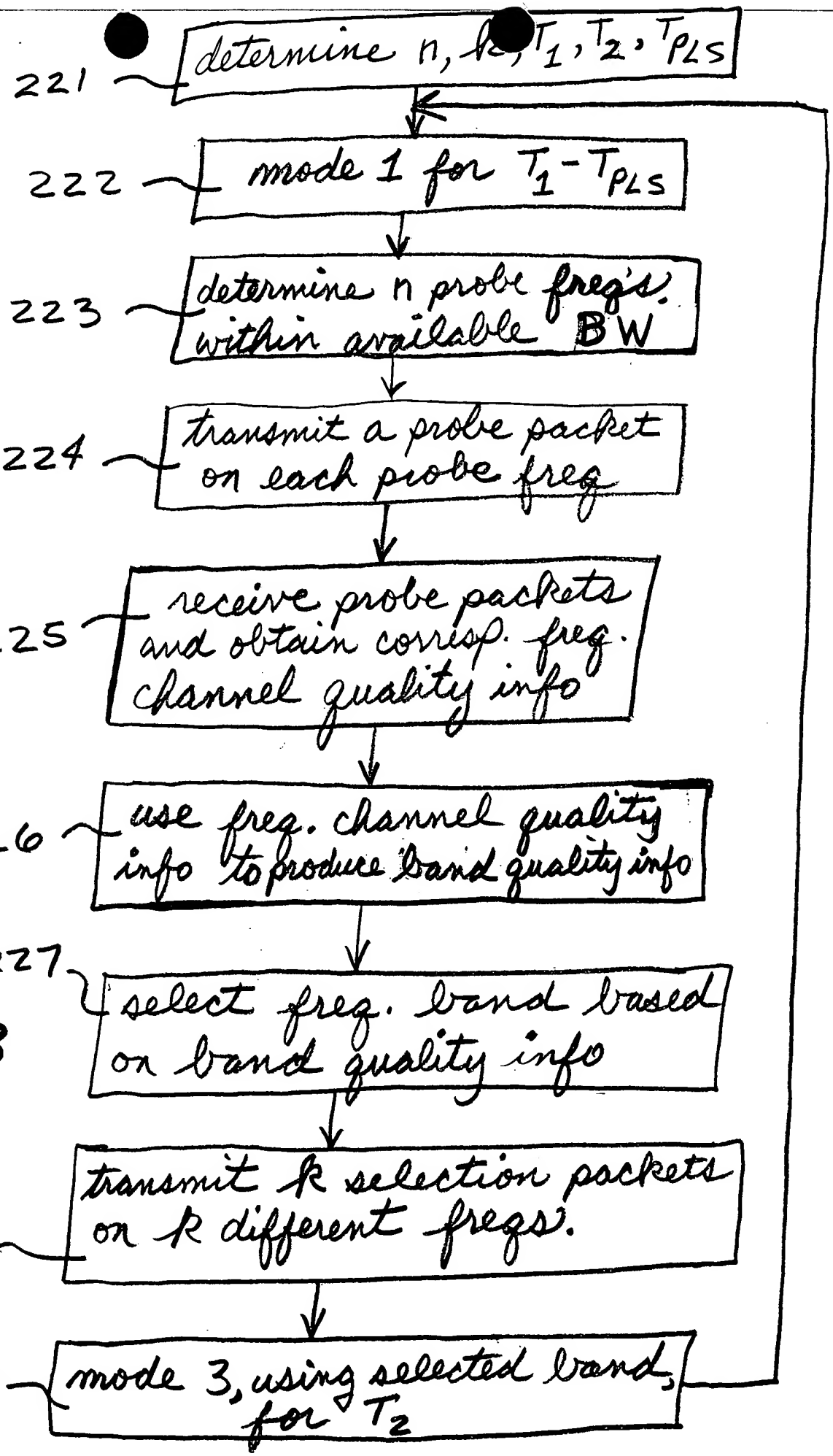

FIG. 21B

T0520 "E02/2650

T0590D0 "60204/260

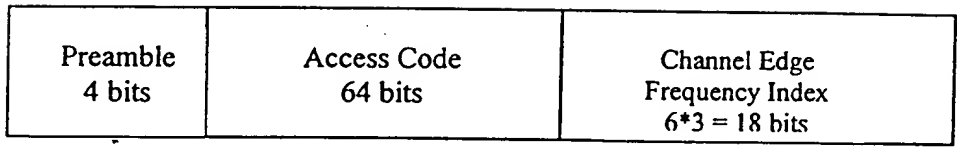

Figure 22

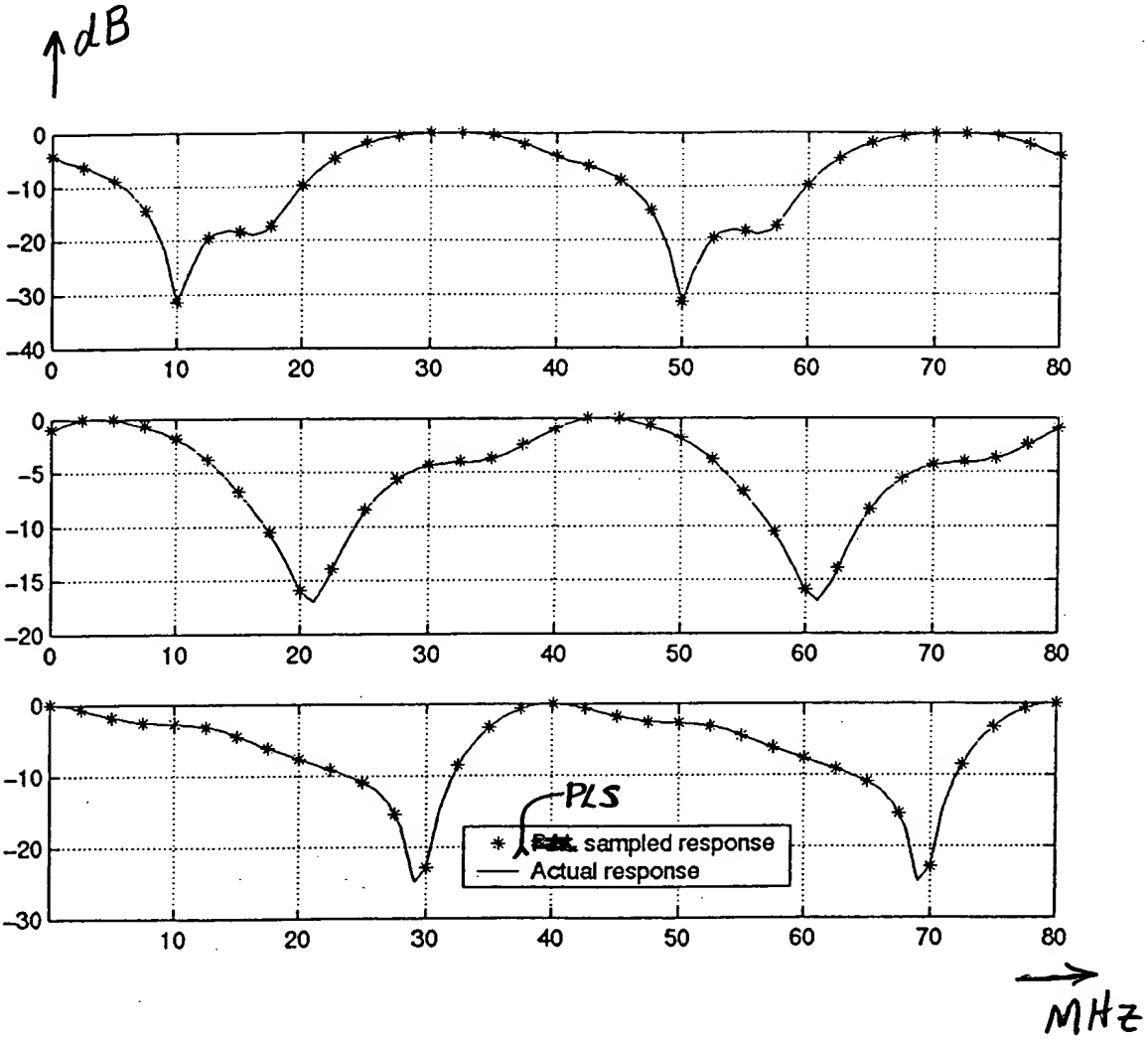
↑dB
0
-10
-20
-30
-40
0
10
20
30
40
50
60
70
80
0
-5
-10
-15
-20
0
10
20
30
40
50
60
70
80
0
-10
-20
-30
10
20
30
40
50
60
70
80
PLS
sampled response
Actual response
MHz

Figure 23

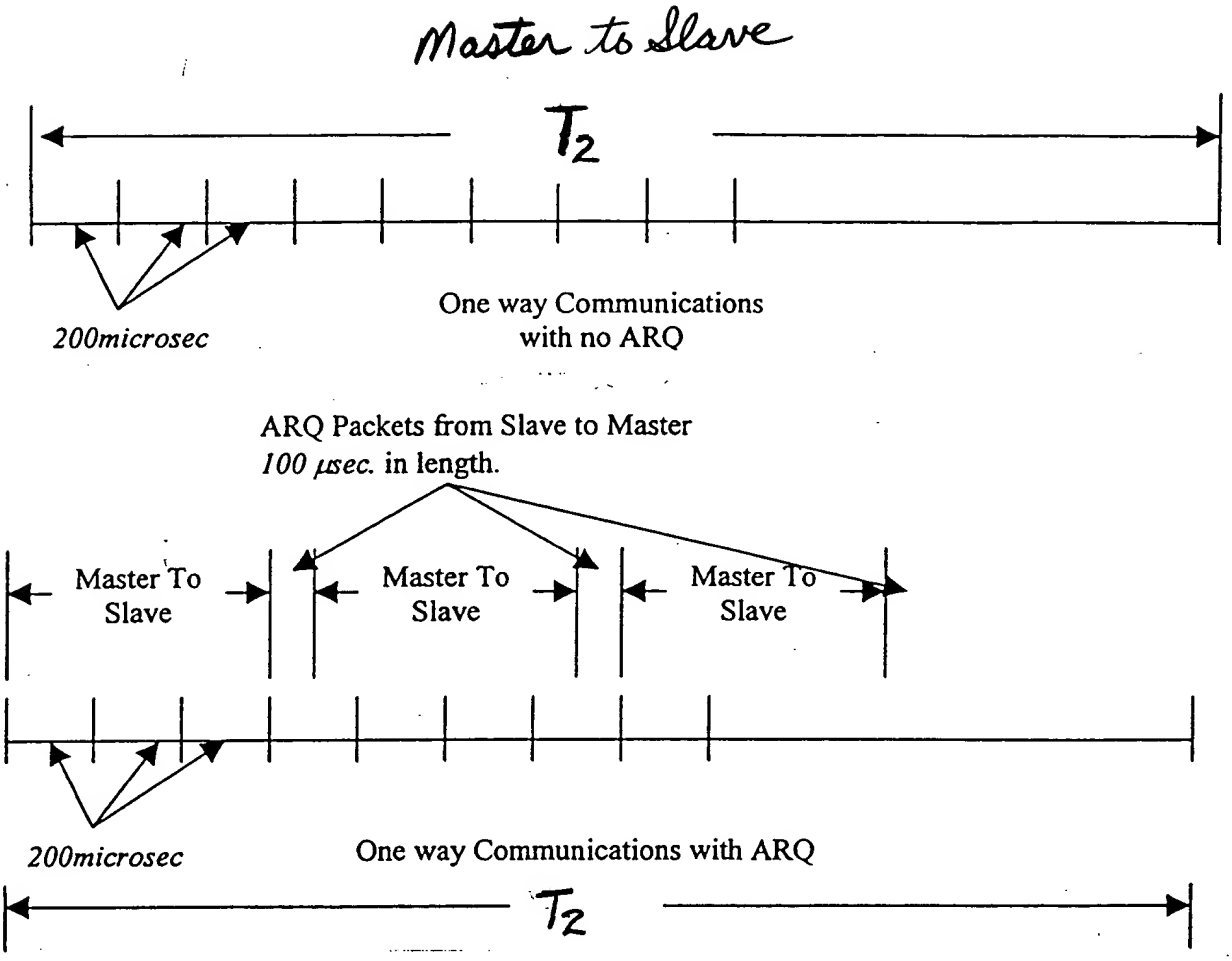
Master to Slave
T2
200microsec
One way Communications
with no ARQ
ARQ Packets from Slave to Master
100 μsec. in length.
Master To
Slave
Master To
Slave
Master To
Slave
200microsec
One way Communications with ARQ
T2

Figure 24

T0550-20-E02/26/03

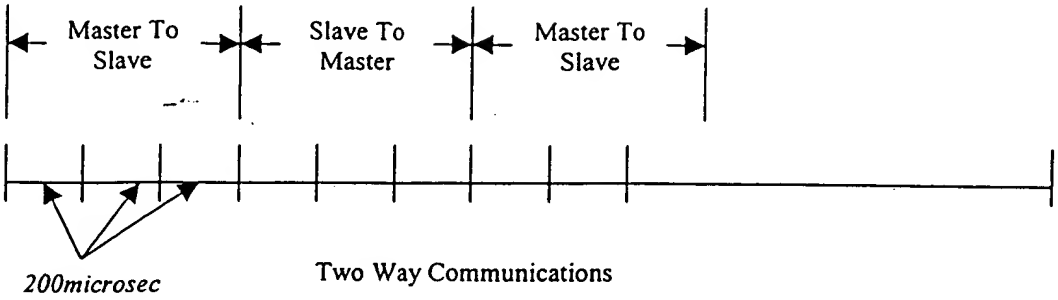

FIG. 24A

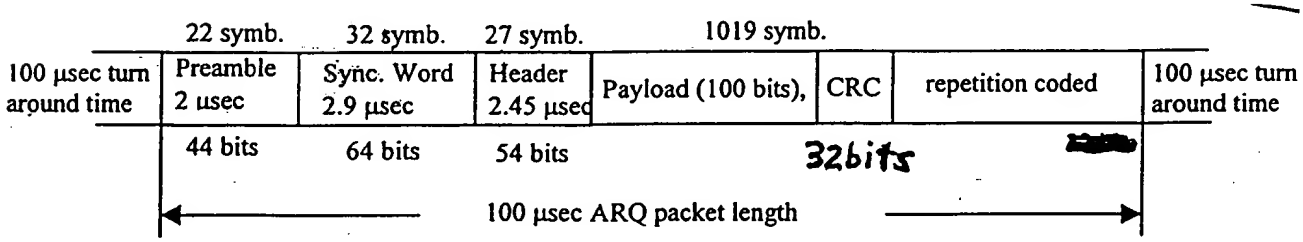

FIG. 25A

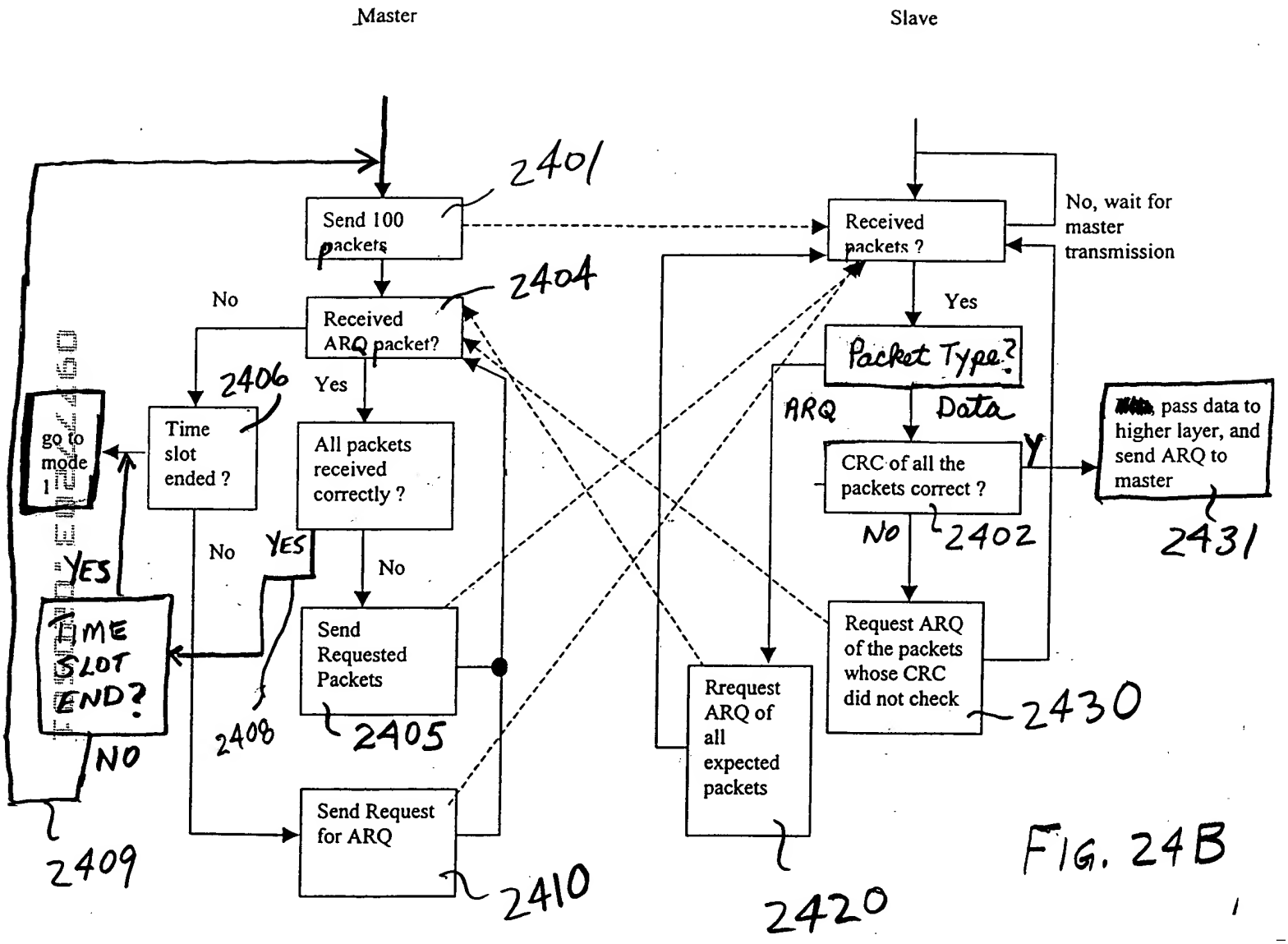
Master
Slave
Send 100 packets
2401
Received packets ?
No, wait for master transmission
Yes
Received ARQ packet?
2404
No
Yes
Packet Type?
ARQ
Data
2406
Time slot ended ?
All packets received correctly ?
CRC of all the packets correct ?
Y
pass data to higher layer, and send ARQ to master
2431
go to mode 1
YES
No
YES
No
NO
2402
TIME SLOT END?
Send Requested Packets
Request ARQ of the packets whose CRC did not check
2430
2408
2405
Rrequest ARQ of all expected packets
NO
2409
Send Request for ARQ
2410
2420

FIG. 24B

TOP20 "EP0277760

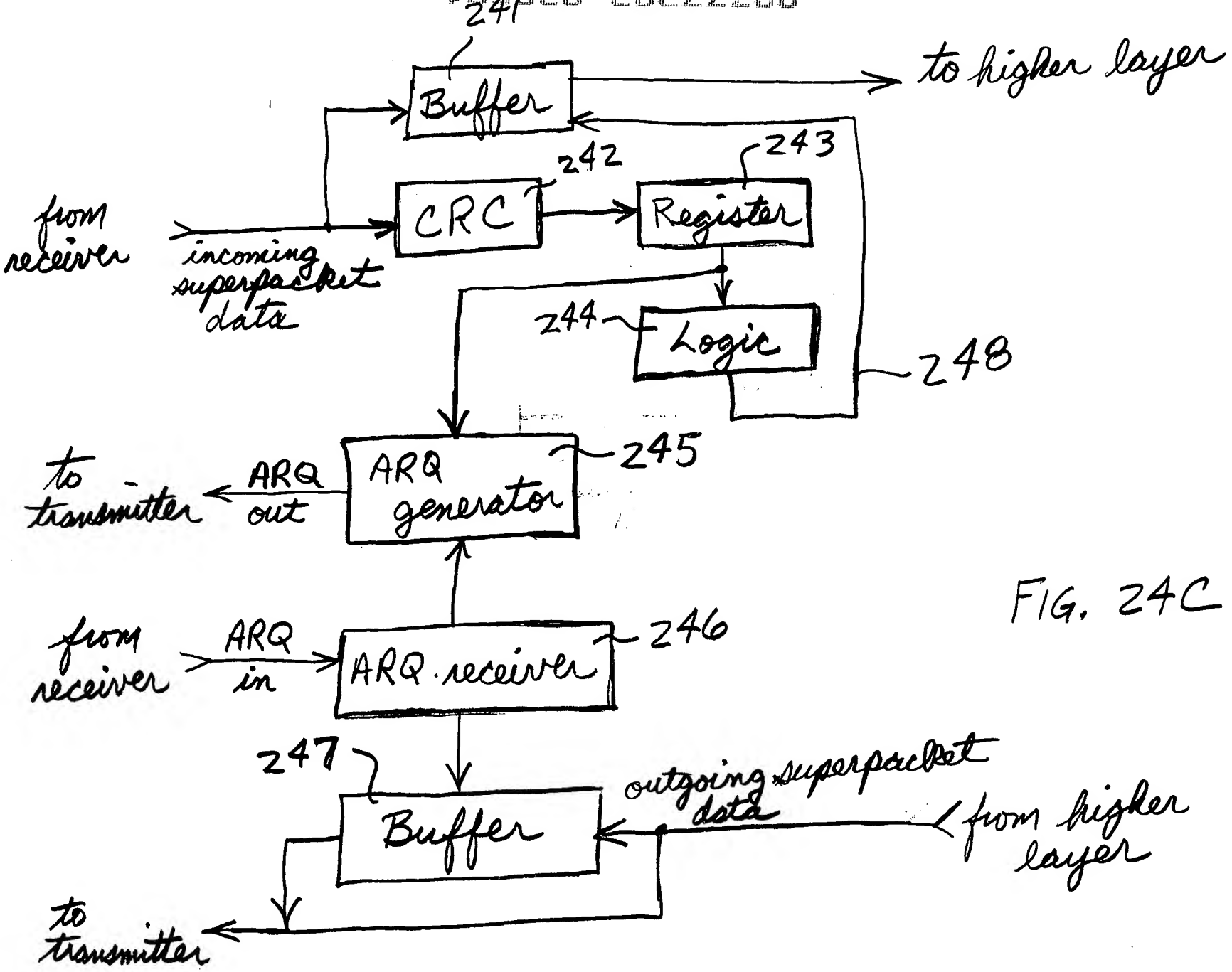

FIG. 24C

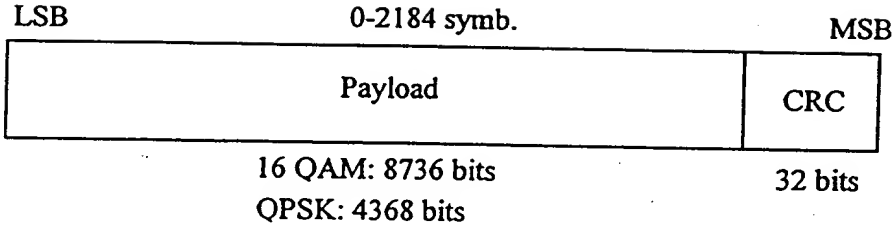
LSB
0-2184 symb.
MSB
Payload
CRC
16 QAM: 8736 bits
QPSK: 4368 bits
32 bits

Figure 25

TC5020-E0324460

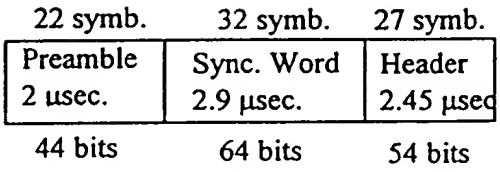

Figure 26

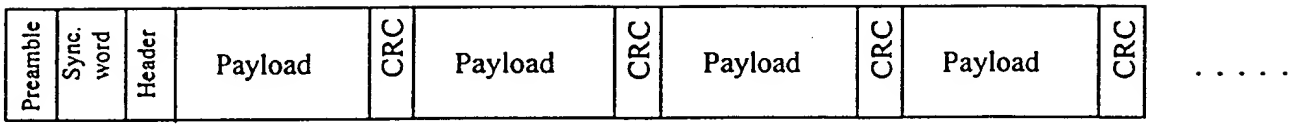
Preamble
Sync. word
Header
Payload
CRC
Payload
CRC
Payload
CRC
Payload
CRC
. . . . .

Figure 27

MPEG2 HDTV Video transmission using Mode 3	
Video data rate	18 Mbps
Video frames/sec	24
Video frames/Mode 3 slot	6
Mode 3 data rate	44 Mbps, 11 MSPS
Coding	Rate ½, Turbo
Modulation	16 QAM
Time in Bluetooth mode (T_1 msec.)	25 msec.
Time in Bluetooth mode for other devices	17.5 msec.
Time in Bluetooth mode for PAL	7.5 msec.
Slot time in Mode 3 (T_2 msec.)	225 msec.
Mode 3 packet size	4.4 Kbits
Data bits/packet	4368
CRC bits/packet	32
Mode 3 packet length	200 μsec.
Number of packets/slot	1030
Length of training sequence	81 symbols, 7.36 μsec.
Number of packets/training sequence	10
Number of packets/ARQ	100
Number of training sequences/packet	103
Time required to transmit video frames (no ARQ)	204.5+1.5+0.76 = 206.76 msec.
ARQ rate	9 %
Time required to transmit video frames with ARQ	225 msec.

EXHIBIT 1050 - 0092/0260

Figure 28

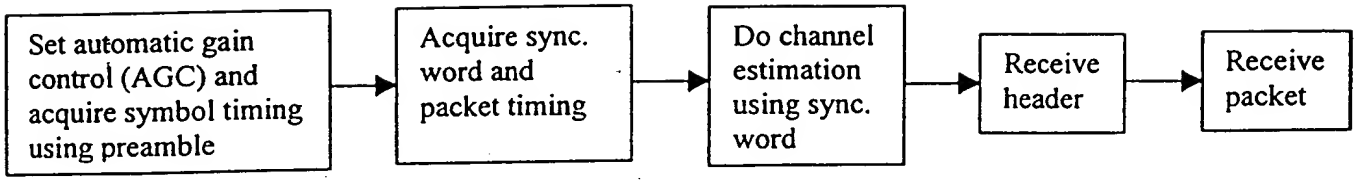
Set automatic gain control (AGC) and acquire symbol timing using preamble
Acquire sync. word and packet timing
Do channel estimation using sync. word
Receive header
Receive packet

Figure 29

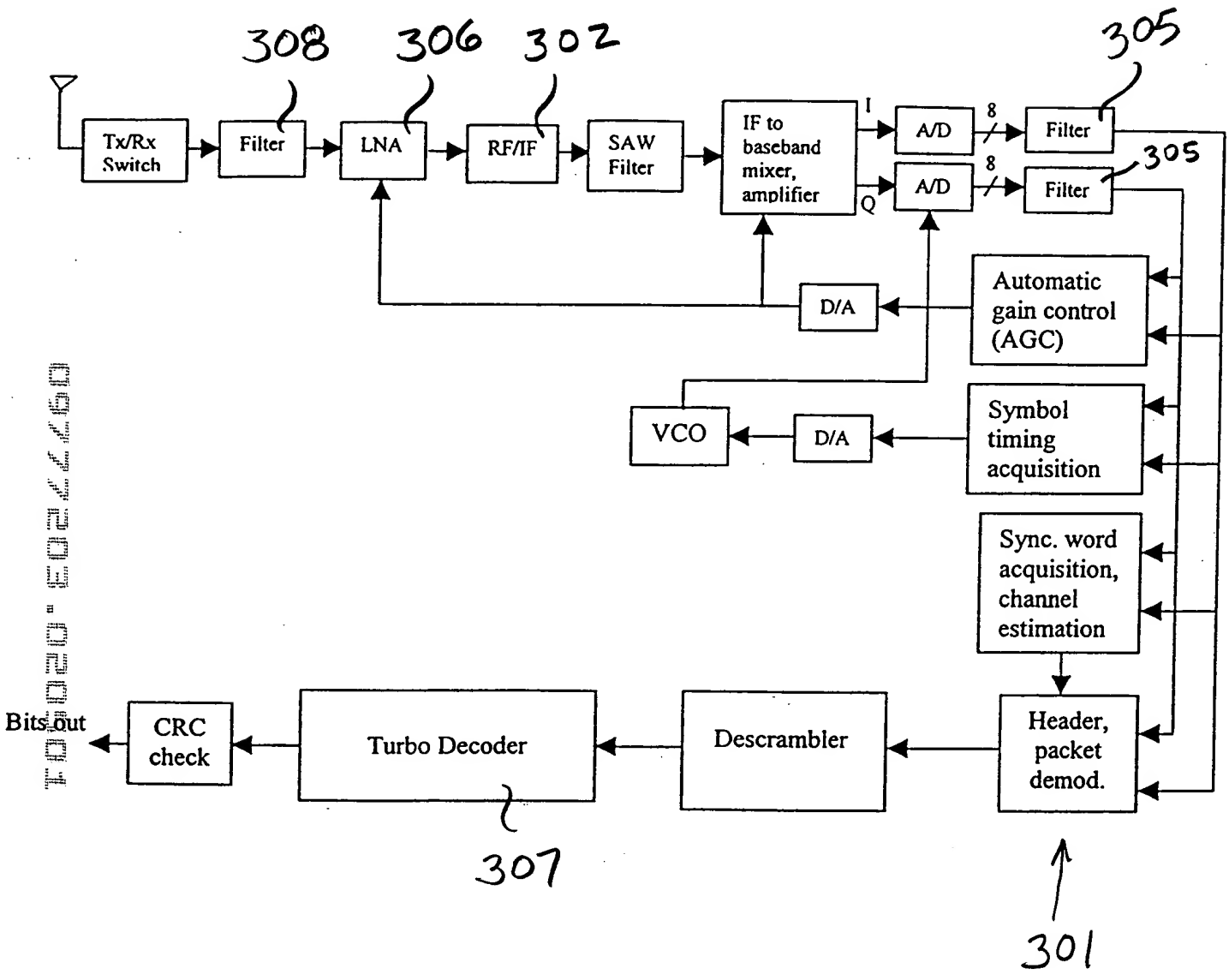
308
306
302
305
Tx/Rx Switch
Filter
LNA
RF/IF
SAW Filter
IF to baseband mixer, amplifier
I
Q
A/D
A/D
8
8
Filter
Filter
305
D/A
Automatic gain control (AGC)
VCO
D/A
Symbol timing acquisition
Sync. word acquisition, channel estimation
Header, packet demod.
Descrambler
Turbo Decoder
CRC check
Bits out
307
301

Figure 30

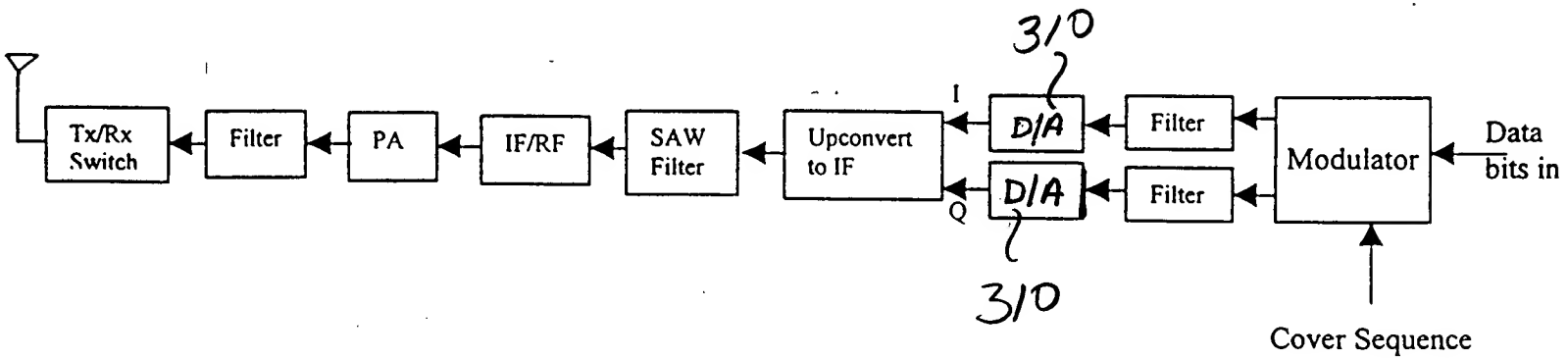
310
Tx/Rx Switch
Filter
PA
IF/RF
SAW Filter
Upconvert to IF
I
Q
D/A
D/A
Filter
Filter
Modulator
Data bits in
310
Cover Sequence

Figure 31

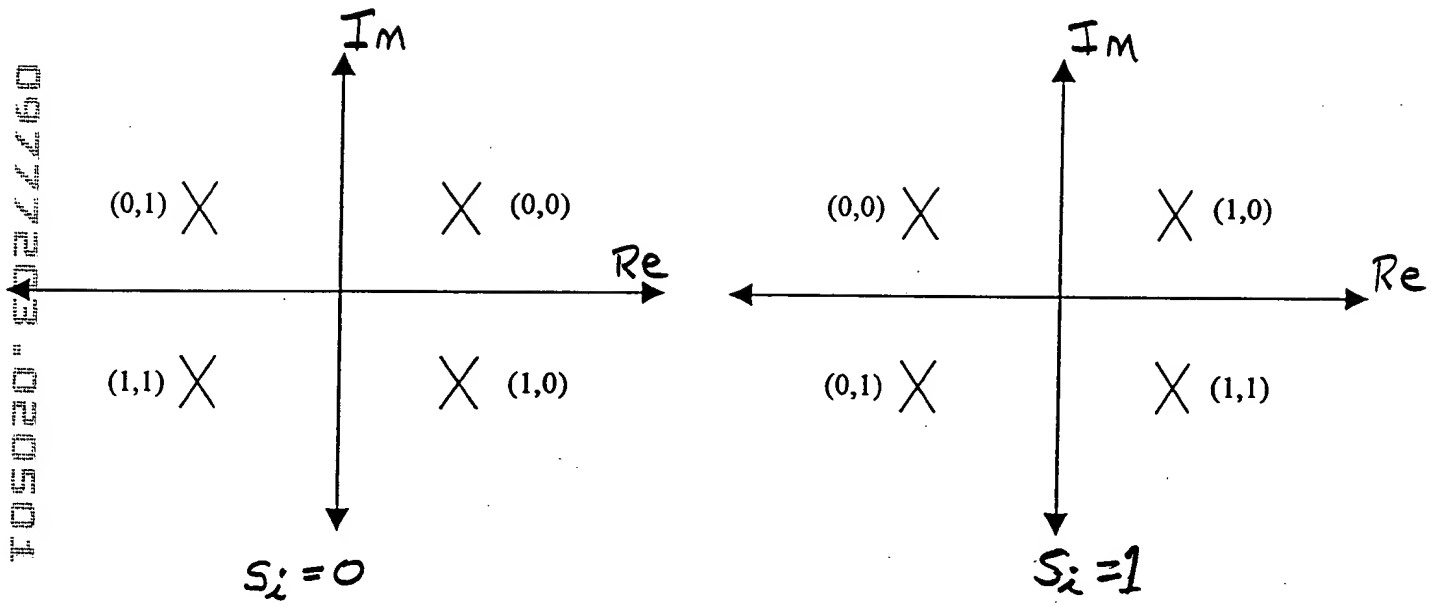

Figure 32

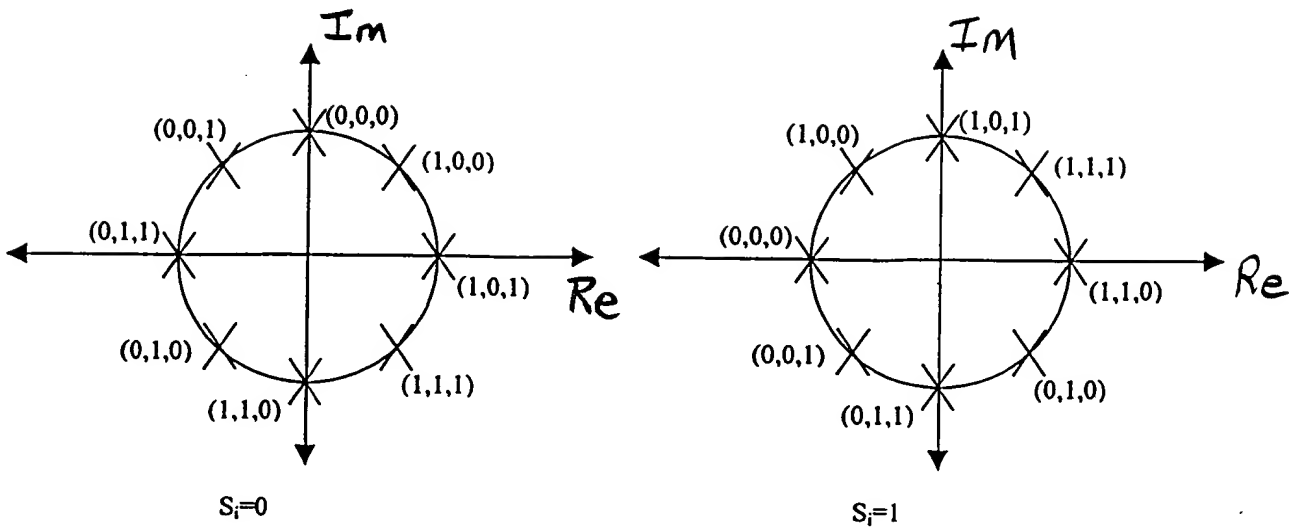

FIG. 32A

EP 0 580 220 A2

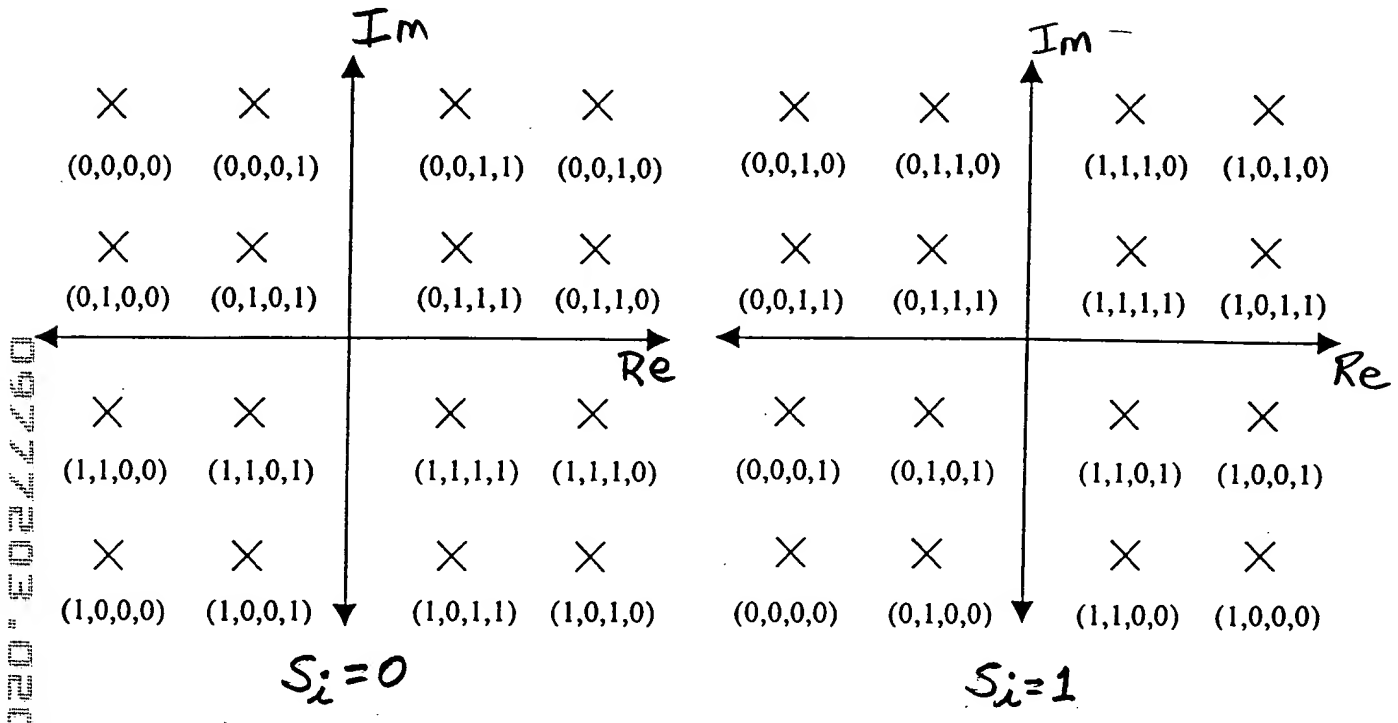
Im
Re
(0,0,0,0)
(0,0,0,1)
(0,0,1,1)
(0,0,1,0)
(0,1,0,0)
(0,1,0,1)
(0,1,1,1)
(0,1,1,0)
(1,1,0,0)
(1,1,0,1)
(1,1,1,1)
(1,1,1,0)
(1,0,0,0)
(1,0,0,1)
(1,0,1,1)
(1,0,1,0)
Si=0
Im
Re
(0,0,1,0)
(0,1,1,0)
(1,1,1,0)
(1,0,1,0)
(0,0,1,1)
(0,1,1,1)
(1,1,1,1)
(1,0,1,1)
(0,0,0,1)
(0,1,0,1)
(1,1,0,1)
(1,0,0,1)
(0,0,0,0)
(0,1,0,0)
(1,1,0,0)
(1,0,0,0)
Si=1

Figure 33

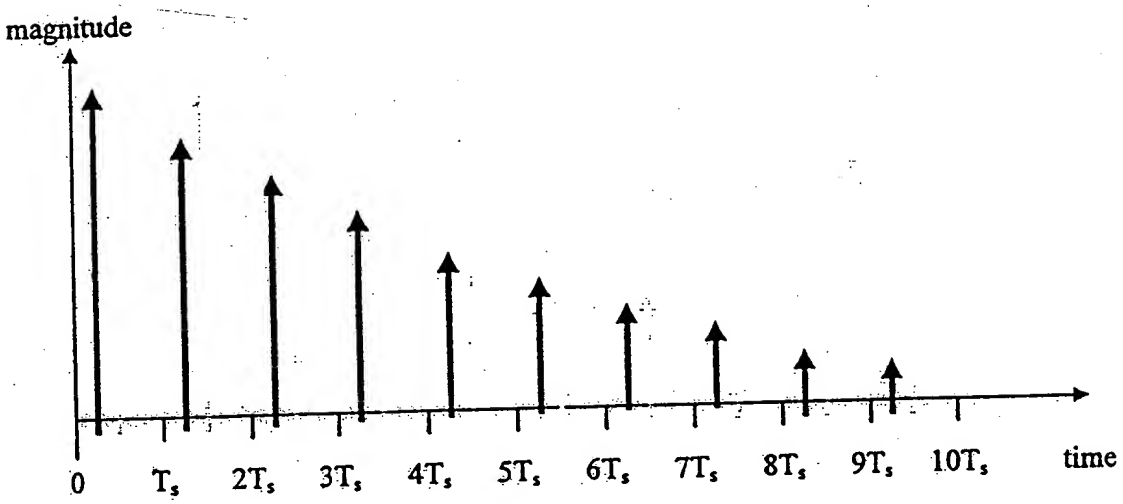

Figure 34

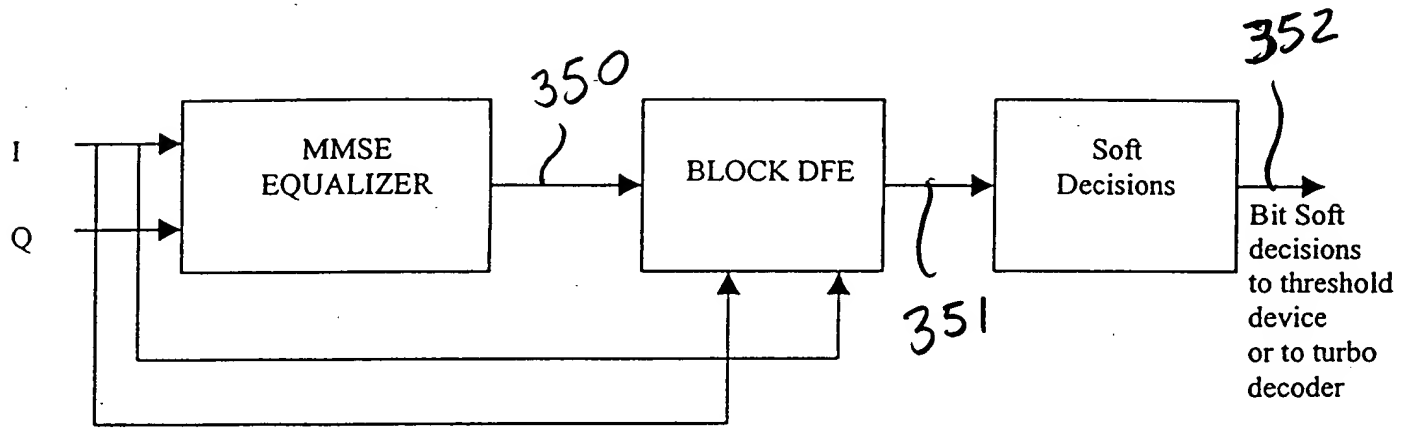
I
Q
MMSE
EQUALIZER
350
BLOCK DFE
351
Soft
Decisions
352
Bit Soft
decisions
to threshold
device
or to turbo
decoder

Figure 35

EP 0 502 760 A2

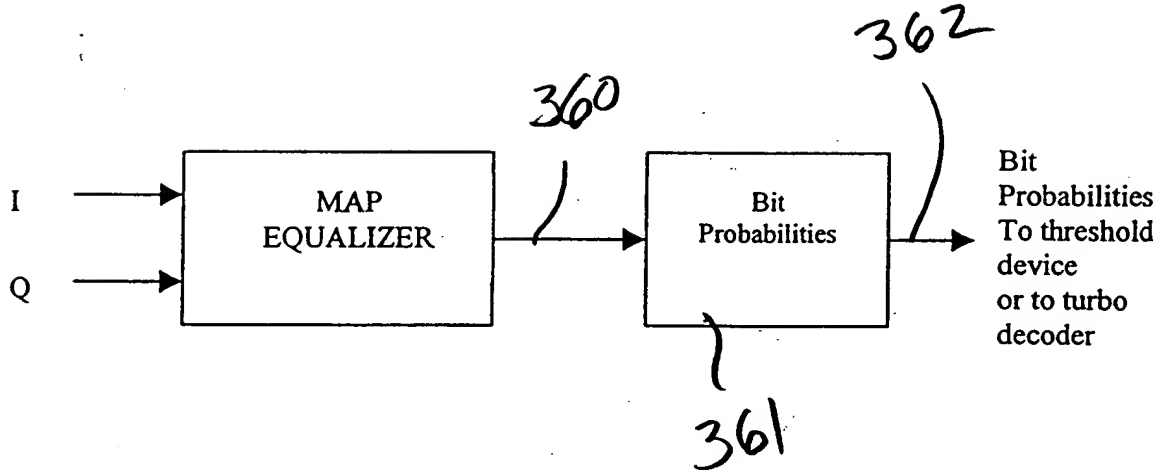

Figure 36

EP 0 520 551 A2

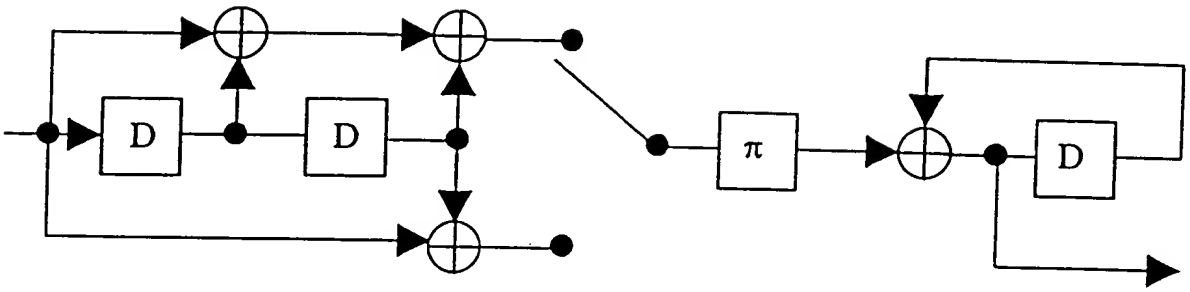

Figure 37

EQ6020 "EQ4250

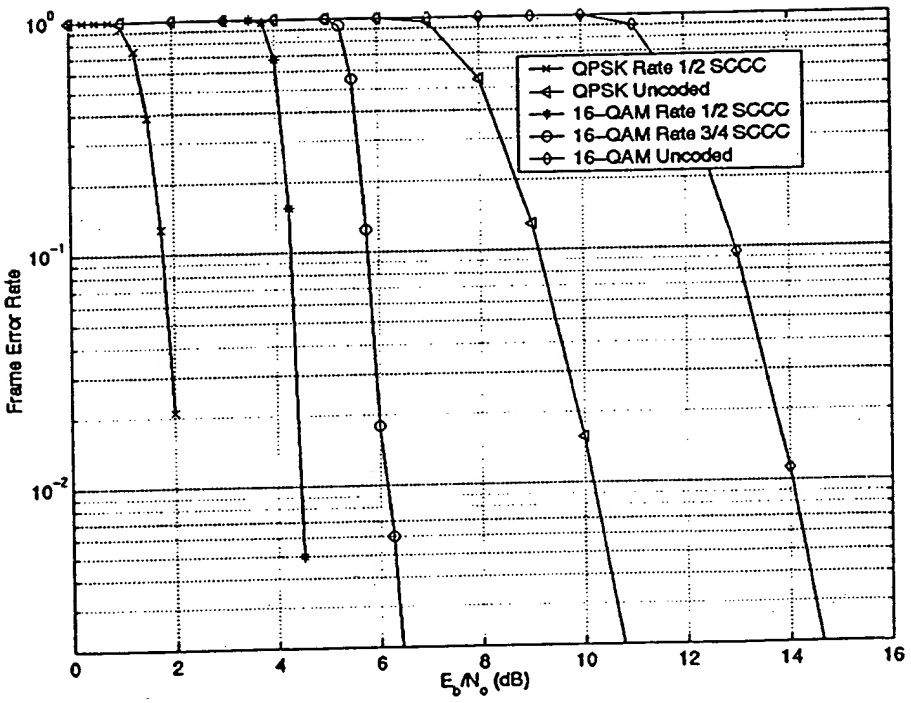

Figure 38

TO520 E02/2/60

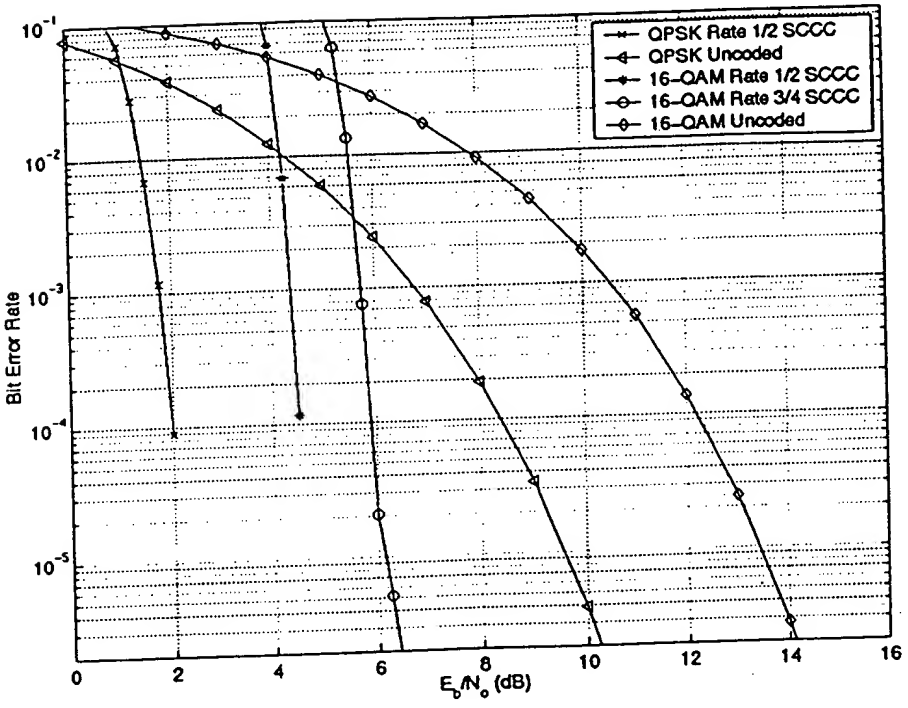

Figure 39

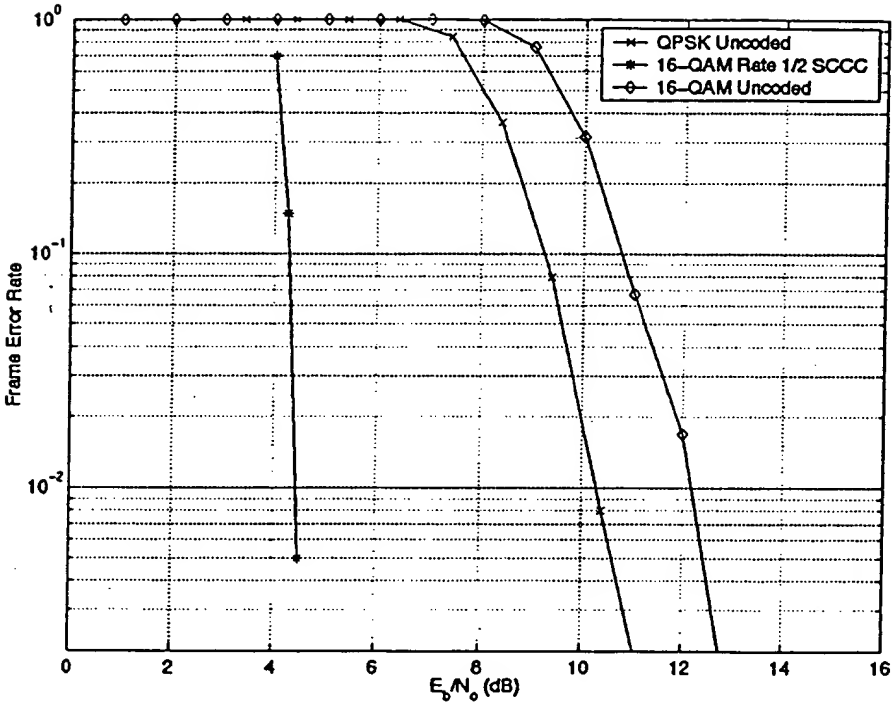
QPSK Uncoded
16–QAM Rate 1/2 SCCC
16–QAM Uncoded
Frame Error Rate
10^0
10^{-1}
10^{-2}
0
2
4
6
8
10
12
14
16
E_b/N_o (dB)

Figure 40

TO5020 "EQUALS"

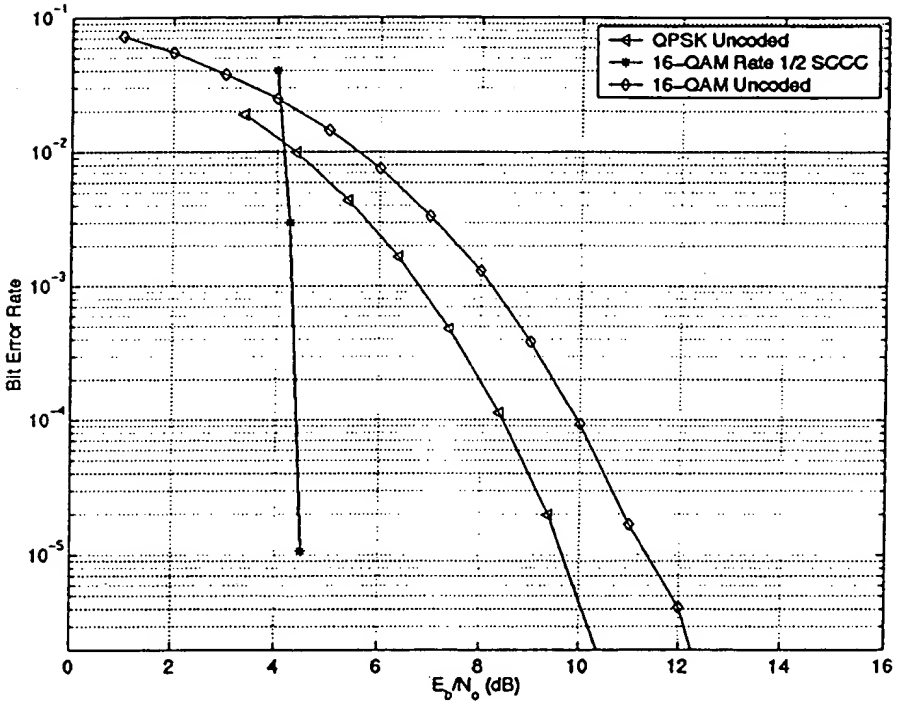

Figure 41

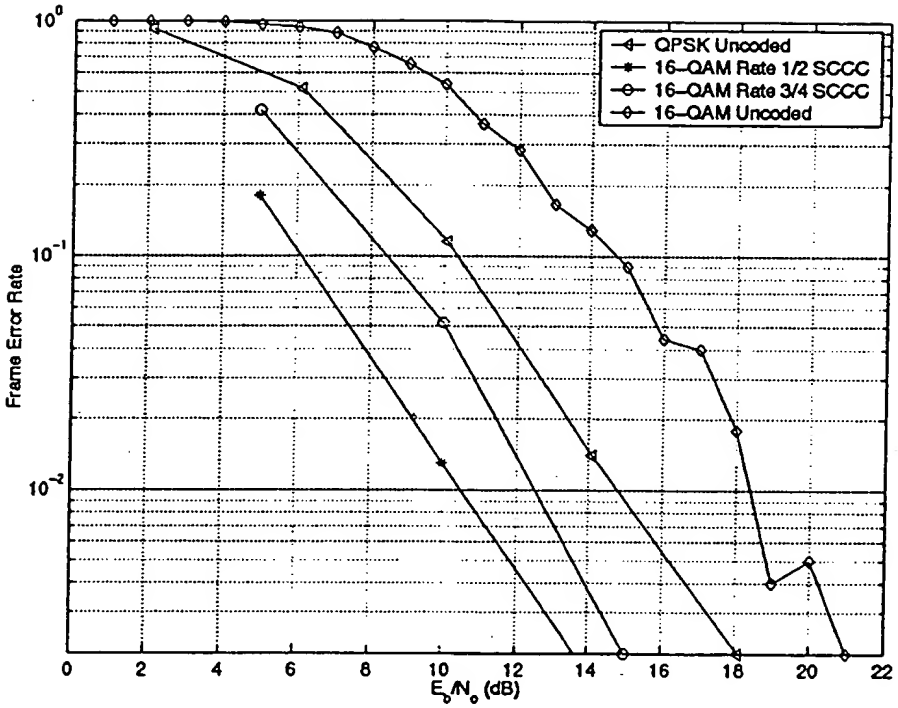
QPSK Uncoded
16–QAM Rate 1/2 SCCC
16–QAM Rate 3/4 SCCC
16–QAM Uncoded
Frame Error Rate
10^0
10^{-1}
10^{-2}
0
2
4
6
8
10
12
14
16
18
20
22
E_b/N_o (dB)

Figure 42

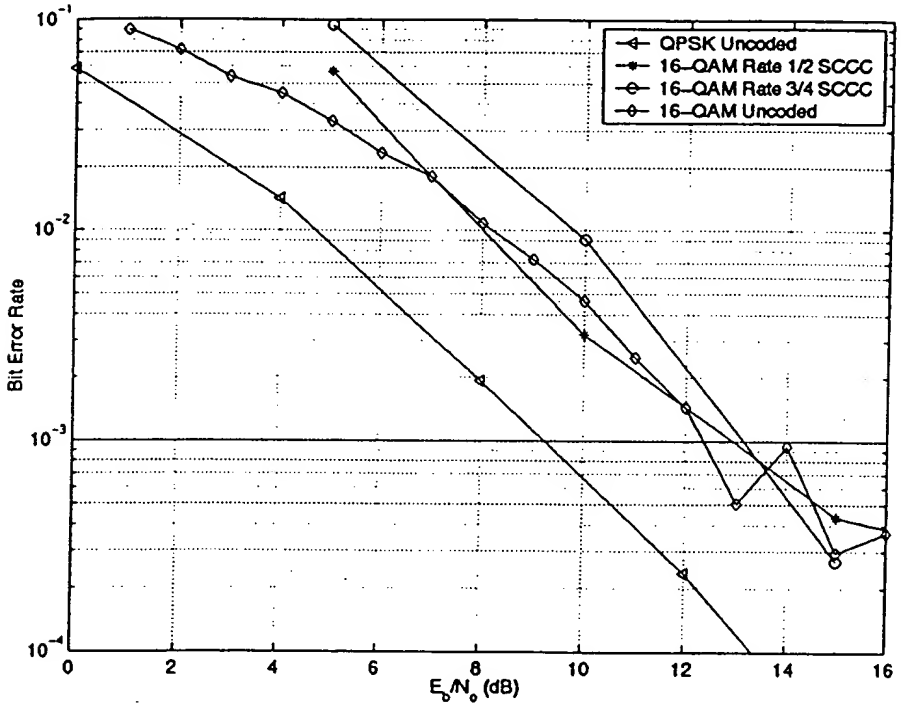
QPSK Uncoded
16–QAM Rate 1/2 SCCC
16–QAM Rate 3/4 SCCC
16–QAM Uncoded
Bit Error Rate
E_b/N_o (dB)
10^{-1}
10^{-2}
10^{-3}
10^{-4}
0
2
4
6
8
10
12
14
16

Figure 43

TO5030-020226P0

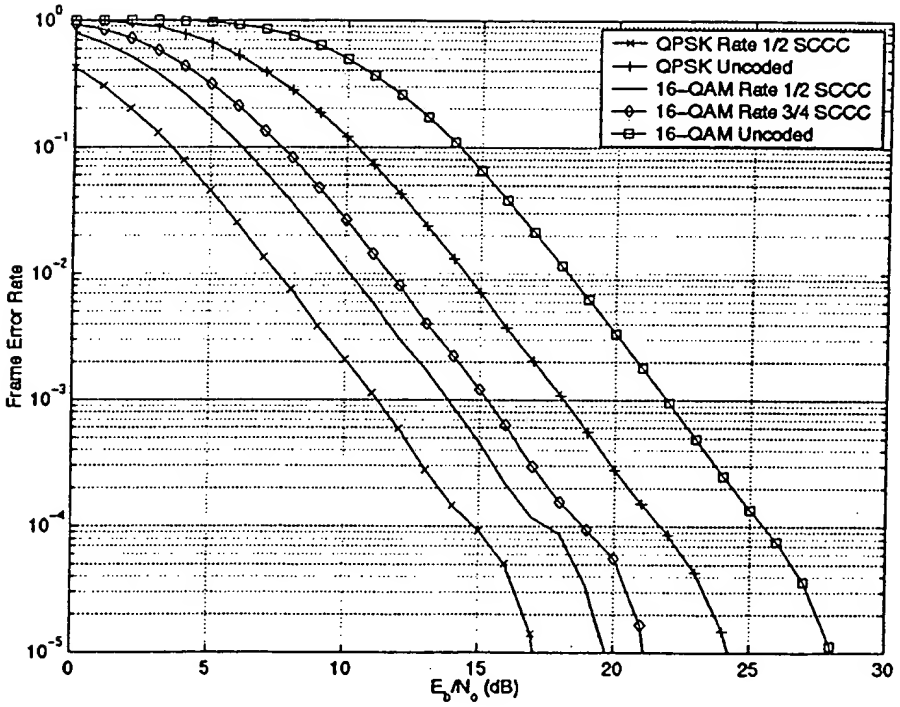

Figure 44